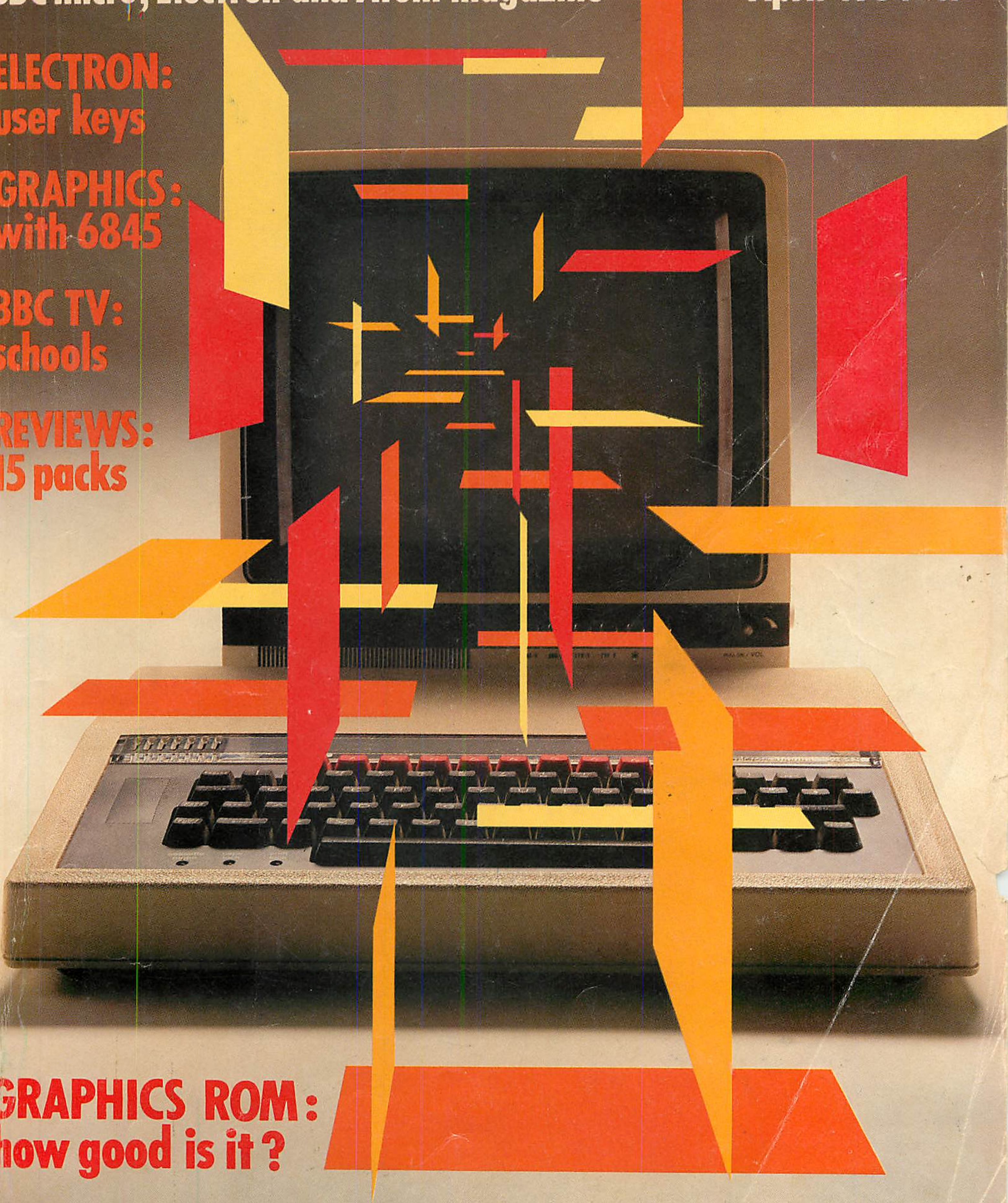
ACORN USER

BBC micro, Electron and Atom magazine

April 1984 £1



ELECTRON: user keys

GRAPHICS: with 6845

BBC TV: schools

REVIEWS: 15 packs

GRAPHICS ROM: how good is it?


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Truly professional units designed to work with the BBC Microcomputer.
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Model B & Econet	£446.00
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Teletext Receiver	£225.00
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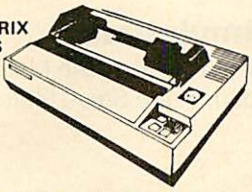
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Basic 11	£32.00
Disk Interface Kit	£97.00

ECONET ACCESSORIES

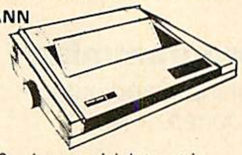
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100M Econet Cable	£99.00
Econet System User Guide	£10.00

DOT MATRIX PRINTERS SHINWA CP80



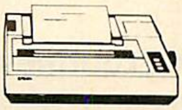
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High quality 80 column serial dot matrix printer. Dual density dot addressable graphics, quick tear facility as standard, optional sound reduction kit to give an impressive L55dBa acoustic noise rating. Ability to handle both tractor-fed fanfold and single paper.
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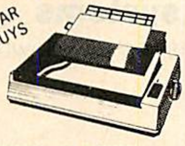


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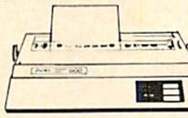


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PHILIPS TP200
Green Monitor

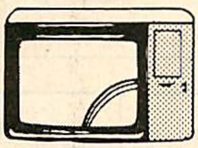


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14" TV/MONITOR

NORDMENDE
14" TV/ MONITOR



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With Remote Control £269

MICROVITEC 14" Colour Monitors

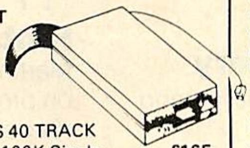
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ONLY £1,329 (incl. all cables)

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KLIK STIK JOYSTICK — SELF CENTRING
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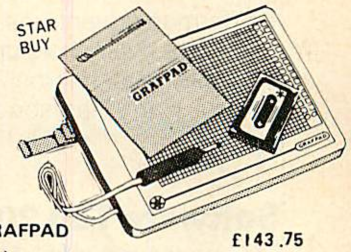
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Monitor	£4.50



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EMS



Meet Uncle Klunk on page 15

How to submit articles:
You are welcome to send articles to the Editor of *Acorn User* for publication. *Acorn User* cannot undertake to return them unless an sae is enclosed. Articles should be typed or computer written with double line spacing. Indicate which machine, Basic and OS the programs are suitable for. Black and white photographs or transparencies are also appreciated. If submitting programs a cassette or disc is vital. Please indicate if you have submitted your article elsewhere. Send articles, reviews and information to: The Editor, *Acorn User*, 68 Long Acre, London WC2E 9JH. Tel: 01-836 2441.

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The Bitstik
Hook up a BBC micro to a second processor with Robocom's joystick-based hardware and you've got a versatile CAD tool. We've got our hands on one

Graphics
More loopy ideas to amaze and astound you and your friends

Discs
A program to check the free space on a disc amongst other utilities coming your way

OS calls
The great debate continues, with Beeb Forum making its contribution on 'illegal' calls, especially in relation to Econet

Forth
Competing BBC versions of this language compared and reviewed

Front cover design by Phil Kanssen

Authors please note

We've been inundated with articles for publication – many of an extremely high standard. It takes time to read them, try listings out and edit them – which is the only way to maintain standards. Also remember that magazines work at least two months in advance.

So please bear with us if you hear nothing for weeks (although all submissions are acknowledged).

Thanks for your patience and apologies for any frustration caused.

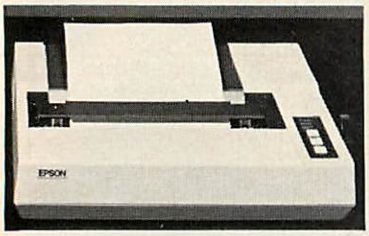
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BBC Computer & Econet Referral Centre

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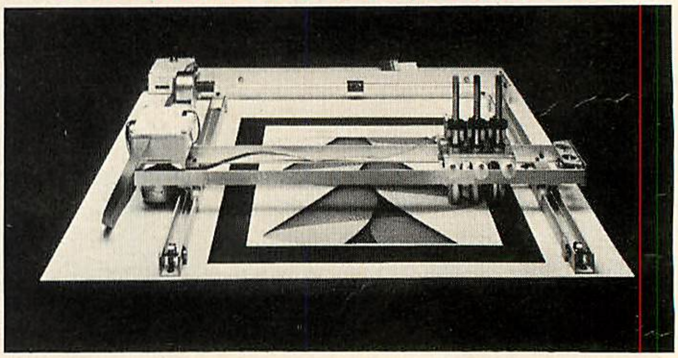
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TECHNOMATIC

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Everything you need for your BBC Computer
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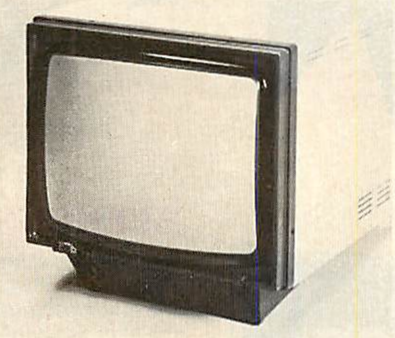
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Continued on page 6

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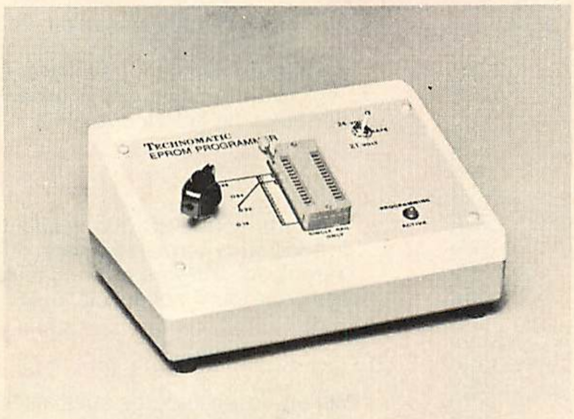
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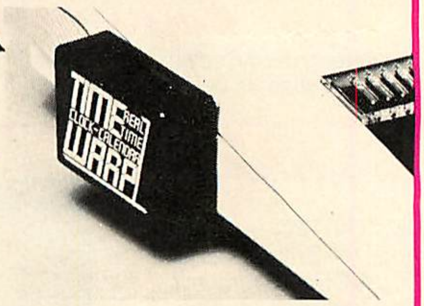


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Acorn profits up by 156%

IN ITS first six months' trading as a public company the Acorn Computer Group's taxable profits increased by 156 per cent from £2.04m to £5.21m.

These debut figures were seen as a disappointment by some City commentators, since the half-year's trading profits were a mere 14 per cent ahead of the previous six months, compared with last year's trebling of profits between the two half-years. However, the cost of setting up operations in the US and West Germany was £2.5m and there are other factors, such as the delay in building up production of the Electron, associated with the world-wide chip shortage.

The half-year figures to January 1, 1984 show that turnover increased from £14.39m to £40.4m and operating profits were over £5m, compared with the previous figure of £2.13m. For the year ending July 1, 1983 they were £8.6m.

The group looks well-placed to increase its profitability by a more impressive margin. Production of the Electron is due to come on-

Start-up costs bite, but should pay off

stream at AB Electronics, Gwent, this month, according to Acorn marketing director Tom Hohenberg. Sales are targeted to reach 40,000 a month, compared with the 25,000 BBC micros sold at present.

Moreover, the US operation is likely to start earning its keep in the second half-year. The Boston-based subsidiary Acorn Computer Corporation has already made inroads into the US educational market. Orders taken were worth more than $50m by the beginning of last month, and the Washington District School Board, Phoenix, Arizona, has put in a $175,000 order.

More than 1,000 dealers have been appointed in North America to sell the Beeb and the American subsidiary has set up a national educational advisory board to vet software for the Acorn micro.

The Acorn Research Centre got under way last month in Silicon Valley and this division is expected to make a significant contribution within a few months.

In the face of speculation about the renewal or lapse of its contract with the BBC, Acorn Computer has maintained its confidence – some would say smugness – pointing out that the Corporation has earned millions of pounds in royalties from sales and is planning future products.

Nor is the replacement of Aubrey Singer as managing director of BBC Television by Bill Cotton likely to affect the collaboration, even though Singer was known to have a personal interest in microcomputer technology. Cotton, former head of Light Entertainment, must have cut his technological teeth as managing director of the BBC's direct broadcasting by satellite project.

The year 1984, therefore seems to hold few terrors for Acorn. According to the *Financial Times* 'a figure of £15m pre-tax looks possible' for Acorn's first full year.

Enter the 6502 and Bitstik

THE long-awaited 6502 second processor has arrived. It is being launched by Acorn this week (March 14) jointly with the Bitstik, the computer-aided design pack. Both are available now, the 6502 at £199 and the Bitstik at £375.

The second processor links to the BBC micro via the Tube output port, bringing an extra 32k of memory but, more importantly, a significant increase in programming speed. For it effectively shares the processing tasks with the Beeb's main CPU, taking charge, for example, of complicated graphic simulations.

The Bitstik, which represents one of the 6502's applications, is an elaborate joystick that enables graphics to be drawn and manipulated on screen, with zooming at any number of levels, rotation of image and output to a printer/plotter. Its great virtue is its user-friendliness, for it operates on two menus and bypasses any keyboard input.

Acorn is marketing Robocom's Bitstik, which it claims is faster than the Apple version, as a professional package appealing to graphic designers, engineers and architects, and anticipates a lot of response from colleges, where applications might include circuit board design and similar experimental tasks. The Bitstik can hold a number of pictures in memory on a central file for later 'assembly' into a main design.

There is still a wait for other Acorn add-ons, however. The business-orientated Beeb user can pencil in May as the next promised month for the Z80 processor, while the Prestel adaptor looks like arriving 'at the end of April'.

The add-on box for the Electron (printer interface/joystick connector) will probably be available in May, says Tom Hohenberg, Acorn's marketing director.

Software boost for microdrives

VIRTUALLY all the leading disc drive distributors in the UK are now promoting the 3in alternative, and the growing range of software makes their task easier.

Advanced Memory Systems, which markets Hitachi 3in drives at £255 (single-sided, 100k) and £399 (double-sided), is one of the pioneers that will benefit from business software for 3in discs from Gemini; a utility range from Clares; educational software from Bourne; and utilities from Beebugsoft.

At Opus, sales manager John Harris predicts a big move into 3in discs: 'Being enclosed in plastic they are very robust and they can be integrated with 5¼in systems. They can be daisychained to provide back-up, and now the software's coming'.

Opus' answer to the AMS's single-sided 3in disc system was a double-sided Sankyo drive at £230, available through W H Smith and other outlets.

Now Viglen is in contention with a TEAC 40-track single 3in disc drive (reversible, 100k per side) at £159, the same price as the comparable 5¼in system. Managing director Vig Boyd explained that his company was late in committing itself to 3in drives because it wasn't happy with the reliability of systems being manufactured. 'We found we had the least comeback with TEAC drives,' he said.

'We've now introduced a dual drive for the educational market for transferring data from 5¼ to 3in discs, and when our 3½in disc drive has been launched in July we'll have a dual case for 3-to-3½in transfer.'

Boyd explained: 'Both standards have a place in the market. The 3in is indestructible and therefore suitable for industrial environments and the rough handling of primary schools, while the more fragile 3½in is replacing the 5¼in discs. This offers greater capacity – 1Mb of storage on 80 tracks.' He estimates its price at about £250.

As yet, he said, he hasn't found a double-density 3in system that operates satisfactorily – 'although we are looking closely at one now.'

A British-made 3in drive for the BBC B has been launched by Northern Computers of Frodsham, Cheshire (0928 35110). Called 'Micro Pulse', this is a double-sided system costing £169 plus VAT.

Meanwhile, back on the 5¼in front, Cumana has reduced prices across the board by about 10 per cent. According to Cliff Musson, the company is passing on the benefits of competitive buying in Japan. He cites the slimline 40 track, single-sided CSX100 drive (100k) at £169 (formerly £185) and the £345 CD200 2×40 track, single-sided 200k drives (formerly £385), and hints that more reductions could be on the way.

John Harris at Opus, however, believes prices have now bottomed out. 'Prices are hardening,' he says, 'because components are in short supply and the Yen is getting stronger.'

As Vig Boyd points out, the chip shortage has been made even more acute by IBM's purchase of Intel. So the message is buy now – don't wait for further reductions.

● Viglen is to release a ROM socket next month that fits externally on the Beeb, enabling the user to snap in the EPROM required.



Northern Computers drives into the 3in market with Micro Pulse for the BBC B

Gemini's ring of confidence

GEMINI appear to have been doing a lot of work on software protection – and their confidence seems tantamount to a challenge to the pirates.

Managing director Dale Hubbard described the protection on their forthcoming database ROM so: 'Life has been made extremely difficult for software thieves with our design and we expect to set a standard of software protection which, no doubt, other software houses will strive to achieve.'

The company announced its intention to go into ROM last year, and the 24k of machine code which makes up the database is expected by May. The system is disc-based, and is claimed to be a 'true random access, database management system.'

A series of applications 'masks' are planned to allow the database to be set up immediately for tasks such as invoicing, stock control, order entering and broking. It is also being converted for the American version of the BBC micro.

The ROM database will be linked to the HCCS suite of business software which Gemini is marketing. This includes nominal and sales ledgers, stock control, invoicing and payroll facilities. The price per module is £99.95.

Hubbard also hopes to see Gemini quoted on the Unlisted Securities Market alongside the Acorn group next year.

The Hulk tamed



SPIDERMAN, the Incredible Hulk and Captain America will be making their graphic entry on to British-owned micros next month – but not on the BBC micro or Electron.

Adventure International (UK) will be releasing their first graphic adventure in May on several computers, but the problem of memory space had led them to settle for a text-based game for the Beeb and Electron.

The Birmingham company has been licensed by the Marvel Entertainment Group of New York to produce at least a dozen adventures over the next 10 years – and it could be up to 60.

Managing director Mike Woodroffe explained: 'Marvel aren't happy with BBC graphics, so we might have a text-based game with a sealed pack of cards to open as you progress.

'Marvel have done all the sketches for the screen layouts and the cover – it's all hand-coloured. There will even be a special comic available separately, called *Questprobe*, and the adventures will follow on from that.'

The games plan is being written by Scott Adams, a leading figure in adventures.

Gail Munn, vice-president of international licensing at Marvel, explained that the company has been keen on getting the graphics right as that was its business. 'We've been disappointed with past efforts so we're looking for the best companies from a design standpoint. We licensed a Spiderman video game and that was just OK, nothing special.

'So we're affiliating with people who really know what they're doing.'

A new Marvel character has been invented called the Chief Examiner, who sends the heroes out on their quests. Although each title will centre around one super-hero, others will make guest appearances and the Chief Examiner will be introduced into Marvel Comics, said Ms Munn.

The first offering from Adventure International will be based on the Hulk and comes out in April at £9.95.

Tape kit translates any Basic

AN ENCODING kit costing less than £4 enables Basic programs to be run on different models of microcomputer. The kit is Basicode, central to which is a translation program that is loaded into a micro to convert a Basic program into a standard electronic code for recording on a cassette. The 'Basicoded' cassette can then be read by any other micro that itself has been loaded with the Basicode translation program.

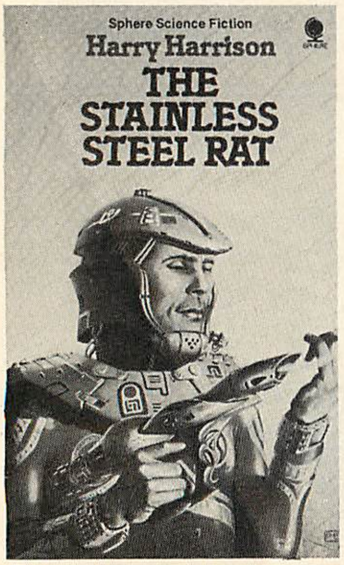
Basicode was created by the Dutch broadcasting corporation NOS and the kit has been available to download software broadcast in the Dutch radio programme *Hobbyscoop* (*Acorn User*, October, page 13). It is now available in the UK from Broadcasting Support Services, who were approached by BBC Radio to handle distribution of a product that would make it possible to decipher the programs put out after midnight by Radio 4's *Chip Shop*. The listener tapes the electronic 'screech' encoded in Basicode and uses the Basicode kit to load the data into his micro.

The Basicode kit consists of a cassette and a handbook. As well as both BBC models, it can be used with Apple II and IIe, the Commodore 64, Pet and Vic 20, Sharp MZ80A, Sinclair ZX81, Tandy TRS80 and Video Genie.

The kit costs £3.95 from Basicode, Broadcasting Support Services, PO Box 7, London W3 6XJ.

Novel ideas at Mosaic

THE *Stainless Steel Rat* author Harry Harrison is working on a computer version of his book featuring the slippery galactic hero Jim deGriz.



Galactic hero Jim deGriz is now preparing for computer action . . .

And Desmond Morris has signed the rights for an adventure game based on his *Inrock* fantasy novel, as revealed in last month's *Acorn User*.

The Harrison adventure is being co-authored by Sean O'Connell and starts off with training and a test to enter the Special Corps, of which deGriz is, of course, a leading member. A copy of the book will accompany the game and, says Harrison: 'Careful study of the book should help you pass!'

Inrock is based around a miniature world under a rock, and the efforts of a young boy to help its inhabitants. The game is being designed and written by Jonathan Griffiths, of *Snapper* fame.

Both projects are being published by Mosiac, who also have the micro rights to Robert Louis Stevenson's *Treasure Island* signed up. Prices for the book and game should be about £15, with the *Rat* coming out in May and the others in the autumn.

THE FEB FOUR

THE February special issue on adventures proved to be a bit more of an adventure than expected.

Among the more unusual tricks that crept in was that the article 'Planning and plotting' was not written by Mike Austin, but his brother Pete. Apologies to Pete (or should it be Mike?).

Next onto 'Cliffhanger' by Peter Killworth. Readers have asked whether he's the one to blame for *Philosopher's Quest*, and yes, we admit it, he is!

Peter is also the (warped) brain behind *Castle of Riddles*, *Countdown to Doom* (his favourite) and *Kingdom of Hamil* (with J Partington). All of these are, of course, marketed by Acornsoft. A fifth game, *Quondam*, written with R Underwood, is nearing completion.

Peter first got interested in adventures when he came across a system for writing them on the IBM 370, written by David Seal and Jon Thackray (whose names you will have seen elsewhere in the February issue).

Key addition

BEEB owners who dabble extensively in data entry or incorporate a lot of mathematical expressions into their programs can break out of the qwerty straitjacket by adding a new keypad from Extron.

At £50, this keypad has 25 keys, including all the numerals and arithmetic operators, together with the nine commonly used shifted characters. They all operate at a single stroke, thus giving the Shift key the elbow.

The keypad comes in a tough metal case matched cosmetically to the Beeb and attaches to the main keyboard via a ribbon cable, requiring no RAM or ROM and leaving the normal operation of the computer unaffected.

It is available, with fitting instructions, from Extron at 16 Priory Park, Bradford-on-Avon, Wilts BA15 1QU.

Local heroes

THE Beeb is about to enter parish pump politics.

The National Association of Local Councils will take the opportunity at its annual conference next month to launch two BBC-based software packages that are specially tailored for the needs of small councils.

There are more than 8,000 parish and town councils in England, involved in the administration of local matters ranging from footpath signs to the construction of sports complexes. Electorates can consist of a few hundred inhabitants in a scattering of hamlets to several thousand in ancient market towns. Whatever their size, though, nearly all of them are fairly busy and the paperwork tends to fall on the shoulders of a hard-pressed part-time clerk.

The situation is, the NALC believes, ripe for the introduction of computer power to community politics.

Work on the project started last July when the association's general secretary John Clark and assistant general secretary Martin Harvey began looking for the best way of introducing the chip revolution into the work of parish and town councils.

'We thought it was about time our members came into the 20th century and stopped using the quill pen,' explains Harvey.

By coincidence, the very next day they were contacted by Andrew Pickering, clerk to Bicker Parish Council and a computer programmer in Lincoln, who explained his plans to develop software suitable for council work to be carried out on a BBC micro.

NALC decided it would be sensible to develop a standardised system that would cope with the type of workloads common to almost every town and parish council.

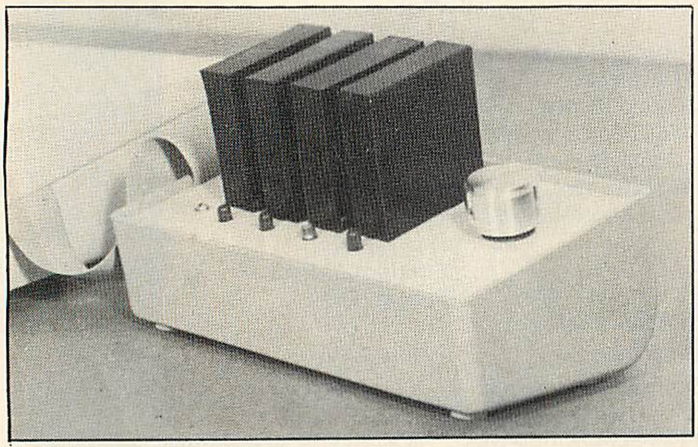
'The idea,' says Martin Harvey, 'was to develop a standard form of accounts preparation, something which could be uniform throughout the country.'

This meant getting the approval of the Audit Commission, whose job is to keep an eye on how councils maintain their books.

Other software prepared includes a program to tackle the problems of preparing council and committee minutes, agendas and the like.

The cheaper of the two BBC packages will be a cassette-based system, while the other will be a 400k disc-driven package. Costs have yet to be fixed but could be about £550 for the cassette system and £2000 for the disc package. The NALC is confident that there will be a rush of councils keen to get themselves computerised.

'We have not even announced the scheme yet but we are already being inundated with inquiries from councils that have heard about it,' said Martin Harvey.



Heat's off for duffers

SO you're a duffer at soldering and you flunked your electronics degree. That won't prevent you from installing your own ROM extension, says Ramamp Computers. The company's new ROM Extension Unit has slots for four plug-in ROM cards and gives an extra 16k of RAM. Each ROM can be switched on-line at any one time, and more cards can be purchased cheaply to slot in more ROMs. It plugs into the Beeb via a ribbon cable. The unit costs £45.80 and the ROM cards £3.80 each. Contact Ramamp Computers at 25 Avon Drive, Whetstone, Leicester, tel: 0533 864966.



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2	(15) CHUKKIE EGG	A&F Software	£ 7.90	
3	(20) 747 FLIGHT SIMULATOR	Doctor Soft	£ 8.95	£11.95
4	(10) THE HOBBIT	Melbourne House	£14.95	
5	(–) APOCALYPSE	Red Shift	£ 9.95	
6	(–) ZALAGA	Aardvark	£ 6.90	
7	(6) HUNCHBACK	Superior	£ 7.95	£11.95
8	(–) SPACE SHUTTLE	Microdealer	£ 8.00	£10.00
9	(–) SNOOKER	Visions	£ 9.95	
10	(–) FELIX IN THE FACTORY*	Program Power	£ 7.95	
11	(–) LORDS OF TIME	Level 9	£ 9.90	
12	(5) KILLER GORILLA*	Program Power	£ 7.95	
13	(–) SALOON SALLY	Psion	£ 7.95	
14	(9) WHITE KNIGHT II	BBC Soft	£10.00	
15	(11) PLANETOID	Acornsoft	£ 9.95	
16	(19) SNAPPER*	Acornsoft	£ 9.95	
17	(3) 3D BOMB ALLEY	Software Invasion	£ 7.95	£11.95
18	(1) DR WHO	BBC Soft	£10.00	
19	(–) TRANSISTOR'S REVENGE	Softspot	£ 7.95	
20	(–) MONSTERS*	Acornsoft	£ 9.95	

BUBBLING UNDER

LOST CITY	Superior	£ 7.95
FAIRGROUND	Superior	£ 7.95
OBLIVION	Bug Byte	£ 7.50
SPACE ADVENTURE	Virgin	£ 7.95

*AVAILABLE ON THE ELECTRON

This chart was compiled from a panel of specialist computer outlets by RAM/C. It is based on returns from mid-January to mid-February.

WHICH will be the biggest software house of 1984? Program Power was laying claim to the title at the end of last year – but other contenders show no sign of lying down.

PP certainly pumps out volume, with at least one new game each month, but Acornsoft wins the numbers game this month with a trio in the best-selling score.

However, they're all the old favourites released in 1982. This seems to shoot down the company's protectionist stance and claims of massive pirating destroying sales. Perhaps the real problem is that the vidiots reckon the new games just aren't as good.

While Acornsoft relies on its backlist, PP is indeed making the running with its *Donkey Kong* derivatives such as *Killer Gorilla* and *Felix in the Factory*.

The Software Invasion range is based on traditional ideas, but the company's interpretation – and the excellent graphics – is all that's needed to set the vidiots going.

Doctor Who is slipping down the charts, to our relief, and *The Hobbit* is holding up well, despite the feeling that the BBC version has lost something in its translation from the Spectrum's 48k.

On the adventure front, Level 9 has jumped in at number 11, hopefully part of a trend we craved last month.

Doctor Soft's flight simulator has fought off Salamander's challenge as it zooms back up the charts. That game's been up and down more times than a yo-yo!

We can't really say much about Bug Byte's number one because we haven't seen it, despite requests to do so. Ah well, can't have everything.

So what's going to be tops of the doobriedoos next month? *Chukkie Egg, Zalaga* or *Saloon Sally* are the front runners round the office (which probably dooms them all to disappear!).

Lingo learning with Linkword

FOUR tape-based packages due from Acornsoft in a few days will help you brush up on your French, German, Italian and Spanish, or pick up the basic grammar and vocabulary.

The packages, costing £14.95, consist of a cassette with ten programs plus an audio cassette to help keep your ear for the accent acute, and a 20-page booklet. The first offerings are for the Beeb but Acornsoft is preparing versions for the Electron.

The main market is expected to be among home users rather than schools. The teaching method is based on Linkword, a technique devised by Michael Gruneberg of University College, Swansea, that links foreign words with similar-sounding English words with the aid of visual mnemonics. The Linkword programs don't take advantage of the Beeb's graphics capabilities but operate on a prompt-by-bleep system.

The technique has proved effective at Thompson Holidays in training managers.

Cheap talk

IT WILL cost you less than £25 to make your Beeb talk. Cheetah Marketing is following up its successful launch of a speech synthesiser for the Spectrum last year with a 'Sweet Talker' for the BBC micro.

Unlike the cased Sinclair version, though, the new one is a printed circuit board with a 28-pin plug which is installed internally into the Beeb's IC99 socket. Cheetah says the installation is simple and requires no soldering or cutting of tracks.

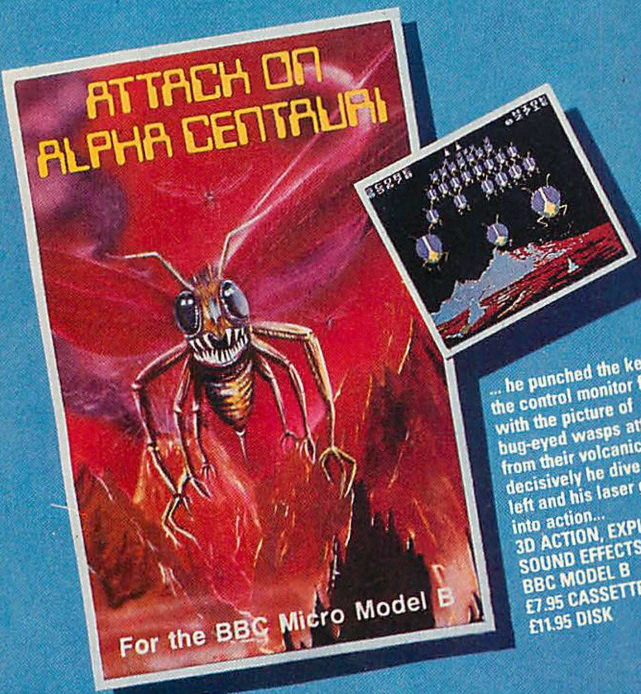
Sounds are produced on an allophone system, so that words, phrases and sentences can be built up in a Basic program. Cheetah sees its product as an amusing toy that will enable you to pep up your games with appropriate 'comments' and other noises. The sounds are broadcast, of course, through the micro's own speaker.

The board comes with a short machine code driver program (making a simple change to one of its 10 lines will ensure its compatibility with all Beeb operating systems), a demonstration cassette, and installation instructions which list the 64 allophones from which all speech can be built up.

Cheetah is negotiating on retail distribution of the Sweet Talker but meanwhile it is available by mail order at £24.95 (inc VAT and p&p) from Cheetah Marketing, 24 Ray Street, London EC1 3DJ (01-278 6954). Orders, we are assured, will be met ex-stock within 10 days.

The invasion has begun... for BBC Model B

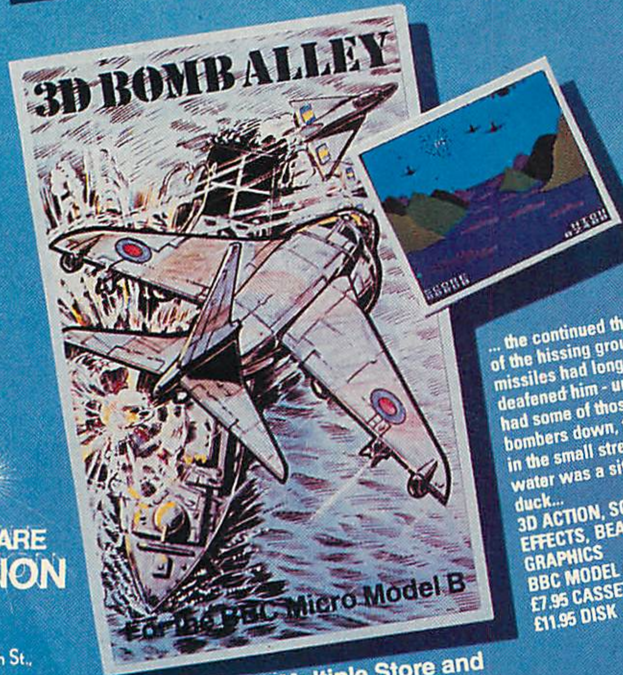
Let excitement invate your home computer! Travel to Alpha Centauri. Enter the Vortex. Command the ground missiles, or join the shoot-out at the O.K. Corral!



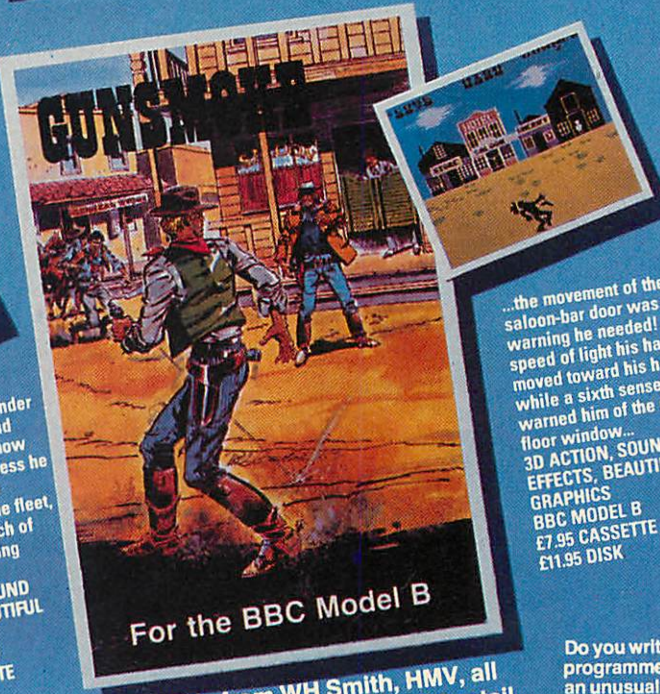
... he punched the key, and the control monitor filled with the picture of bug-eyed wasps attacking from their volcanic nest; decisively he dived to the left and his laser gun burst into action...
3D ACTION, EXPLOSIVE SOUND EFFECTS
BBC MODEL B
£7.95 CASSETTE
£11.95 DISK



... there was no escape, he had to enter the Vortex and bet on his skills! He grabbed the manual controls and with determination fired both upper deck guns...
KEYBOARD OR JOYSTICK, EXCELLENT SOUND
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£11.95 DISK



... the continued thunder of the hissing ground missiles had long now deafened him - unless he had some of those bombers down, the fleet, in the small stretch of water was a sitting duck...
3D ACTION, SOUND EFFECTS, BEAUTIFUL GRAPHICS
BBC MODEL B
£7.95 CASSETTE
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...the movement of the saloon-bar door was all the warning he needed! At the speed of light his hand moved toward his holster, while a sixth sense warned him of the upper floor window...
3D ACTION, SOUND EFFECTS, BEAUTIFUL GRAPHICS
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Total £

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EMS



Putting the finishing touches to Uncle Klunk. Note the cable running from the chair, and the Apple computer on the left

Klunk clicks with Auntie

THUNDERBIRDS are go as far as the BBC is concerned, with computer-controlled puppets and robot 'spiders' featuring in the new television series Computers in Control.

Uncle Klunk (a sports commentator) and the Rock-a-Fire Explosion band are life-sized animated puppets who star in American pizza parlours, while Disney has produced its own versions called 'Animatronics' for Epcot in Florida.

These figures are used as examples of how solenoids, pistons, motors and relays can play out 3D cartoons once under the control of a micro.

The 'spider' is a six-foot, six-legged automaton which pops up in one programme to illustrate a more serious example of robots used for surveillance in places where man *might* not want to boldly go.

American examples are matched by studio projects using the BBC micro. Binky (who for some unknown reason is called Steve in the series) is a ventriloquist's puppet which is hooked up to a Beeb.

Other BBC examples include a sophisticated, turtle-like graphics plotter from Cheswell Graphics, an 'intelligent' BBC Buggy – and a home security system.

Paul Bond, one of the leading lights behind the BBC micro's operating system, devised the security system to make use of voice recognition. The micro compares sound envelopes to decide whether the person telling it to switch on the central heating over the phone should be allowed to.

The 'Buggy Brain' is an Economatics BBC Buggy with a cut-down BBC micro attached by Control Universal. A board holds the Basic, OS and memory chips with battery support and an RS232 interface. This means it can be programmed down the RS232 port from another BBC micro and left to its own devices – no strings, no cables.

Several interfaces are demonstrated: the Beasty, Interbeeb from RH Electronics, and Unilab's offerings.

Two location sequences show John Coll and Ian McNaught-Davis, who host the five-part series, at Lotus Cars and Southampton University.

Lotus have developed a computer-controlled suspension system for racing which keeps the cars on an even keel – even at 100mph round bends!

Southampton University shows off a new type of wind tunnel which does away with the need to physically support any model under test. The model is fitted with a magnetised metal device and sits in a cylindrical tunnel. This means its position can be altered by magnets surrounding the tunnel, and, of course, computers do all the controlling.

David Allen, the producer, and Robin Mudge, the director, hunted out the US stories and spent time at the Chicago Robot Show with the likes of Hero, mentioned in last month's news pages.

Mudge was particularly impressed with the Disney anima tronics. These puppet-robots are programmed by animators in a similar way to cartoons. The animator chooses the start and end positions, then a computer does the 'in-betweening' to produce realistic movement.

Characters such as Uncle Klunk and the band are controlled by micros, with recorded voices. In our pictures of the Klunk assembly line, an Apple can be seen connected up to the puppet, and bear drummers are visible in the background. Creative Engineering in Florida, who build these puppets, also show off Fatz, their friendly gorilla in the series.

The five episodes include an introduction to robotics and control; ways in which a micro can monitor and react to its environment; motors, solenoids and relays; problem-solving and dedicated computers; and the future: what robots will be capable of as speech and pattern recognition are developed.

Programme times and dates

Computers in Control started on Friday, March 2, with repeats on the following Thursdays and Sundays. The times are Friday at 12.30 on BBC2 (first showing March 2); Thursday at 23.30 on BBC1 (first repeat starts Thursday, March 8); Sunday at 12.35 on BBC1 (second repeat starts March 18). Many of the programs used in the series will be available from the Telesoftware Service on Ceefax.

Notes on the programmes cost £1.30, plus a large sae, from Computers in Control, Broadcasting Support Services, PO Box 7, London W3 6XJ. The NEC is also preparing a course on control for BBC micro users.

ACORN ABUSER'S Diary

Go on Dan, we dare you!

WHEN will British companies wake up to the potential of micros? The Americans are going hell-for-leather to market software in their products while we sit back.

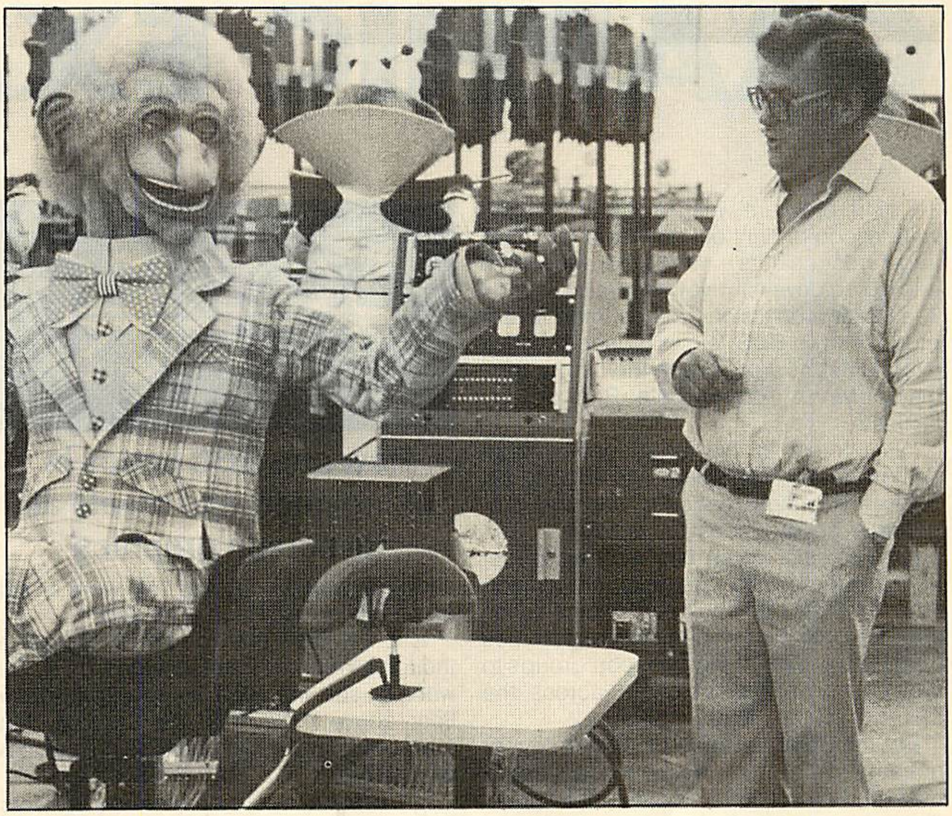
A classic example is the Marvel deal in adventure games – there could be 60 over the next 10 years with the whole Marvel Universe, from the Silver Surfer to the Fantastic Four making an appearance.

Where are the Bash St Kids? Dan Dare? Or for that matter Gollum and Biggles?

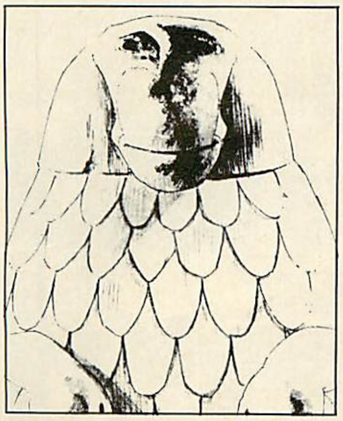
The attitude is typified by Allen & Unwin. They licensed Melbourne House to do *The Hobbit* three years ago, but there's no sign of a follow-up.

As Rayner Unwin says: 'We're not sitting upon any gold mines. We cannot sell *The Hobbit* to anyone else, otherwise Melbourne House would spit.'

The American attitude at Marvel: 'We're absolutely aggressive. This is our first software deal, but we're already talking to a British educational publisher.' They're happy to do other deals 'as long as it doesn't overlap with the adventures'.



Uncle Klunk and Mac in the puppet factory . . . but what is Mac saying to Klunk? £5 for the best suggestion by April 9



We've been nagged into it, folks. Mad Alex has been really peeved that we haven't shown his picture in our recent Dungeon competitions. So here it is!

Syntax error

IMAGINE should be taken to see a greengrocer. Not because they're a load of cabbages (their software is quite good considering the machines they write for), but because the people who write their advertisements might learn a thing or two about apostrophes.

There's a well-known phenomenon called the greengrocer's apostrophe, whereby traders have a habit of inserting these little gems of punctuation where they're not needed: hence, cabbage's 55p each. Imagine's trick is to leave them all out: hence 'weeks time', 'whats more'.

Now this lapse can be explained, or excused, by a useful get-out called 'style': some magazines and advertising copywriters might spell connection with an 'x', or use, say, 1000 rather than 1,000. (Although forgetting apostrophes might seem an extreme style, it has been done. George Bernard Shaw was apparently anti-apostrophe and had them all left out of some of his books. Adverse public reaction led him to change his mind*.)

However, even allowing for style, this sentence in the Liverpool firm's latest advert is nonsense as a piece of English: 'When such computer wizards as . . . are locked away for weeks on end, anything can happen, will they maintain their sanity, or whats more to the point can you control your patience?' There's at least a semi-colon and apostrophe missing there.

It reminds me of the remark by one English teacher to a particularly bad pupil: 'I sometimes wonder if English is your native language.'

Here's hoping they improve their grammar before converting *Arcadia* for the Beeb!

Stop press: they're at it again! The latest Imagine ads leave out question marks left, right and centre.

**'Keep Taking the Tabloids' by Fritz Spiegl (himself no stranger to Liverpool) gives a good low-down on the greengrocer's apostrophe (page 166).*

Name of the game

OUR favourite Editor was a little subdued one Monday a few weeks back. Normally the Ed is just grumpy as he's suffering from the after-effects of playing football on a Sunday, but he's soon giving accounts of his astounding footwork on the left-wing (hence the name Big Ed).

On this day, however, it took several pints of The Black Stuff (Guinness to us) before he finally admitted over breakfast that his team had been thrashed 11-1 the day before (yes, eleven, not two).

But the final ignominy was yet to come. 'What was the name of the team that could defeat The Cavaliers so heavily?'

Ed looked up with contempt in his eyes, made some terrible remarks to his questioner, and replied, while trying not to cry into his beer: 'Acorn ***** Anodysing!'

JARGON JUNGLE

WE'VE read some rubbish in our time (as well as written it) and we reckon you've stumbled over the pretentious, the inept and the gobblegook on your travels through the technological column-inches. So let's see who can snip out the looniest lines, the most turgid turns of phrase, the brightest gems of obfuscating jargon. The cutting printed will win a fiver.

To start you off, we've picked a golden oldie (the *Financial Times*, February 1983). P J Cavill, Inmos technologist, is being quoted on the subject of the transputer:

'An optimum length instruction lookahead *maximises* store bandwidth ultilisation and minor cycle pipelining is used so that all microsteps are fully overlapped with microcode fetches.'

GRAPHIC EXAMPLE

How one BBC series is using micros to create all its screen graphics

'I CAN'T program well, I might just about write a loop to print out my name ten times in different colours – with a following wind and going downhill.' Now that might sound a strange admission from a man who's producer of a BBC television series which is breaking new ground in the use of BBC micro graphics, but Dr Peter Bratt doesn't think so.

His interest in the Beeb comes from being a 'technology freak' who loves to get hold of the latest gadgets: and the programme he produces for schools – *Science Topics* – gives him access to just about all the hi-tech toys he could wish for. That's why the opening credits to the series are written by a laser, and the programmes make use of everything from pop groups to space shuttles to try to put across the theory of science to teenagers.

But the Beeb isn't used just as a toy, or because his office is below those intrepid men who produced the computer series. The Beeb is there to put across the ideas in graphical form. The pictures on page 19 show some of the results; they were all set up on a Beeb, and then animated.



Who writes the graphics software though? Well, as Peter couldn't do it, he went to see the BBC micro experts one floor above: 'They told me to go to Ian Trackman, and he's been doing the job ever since'.

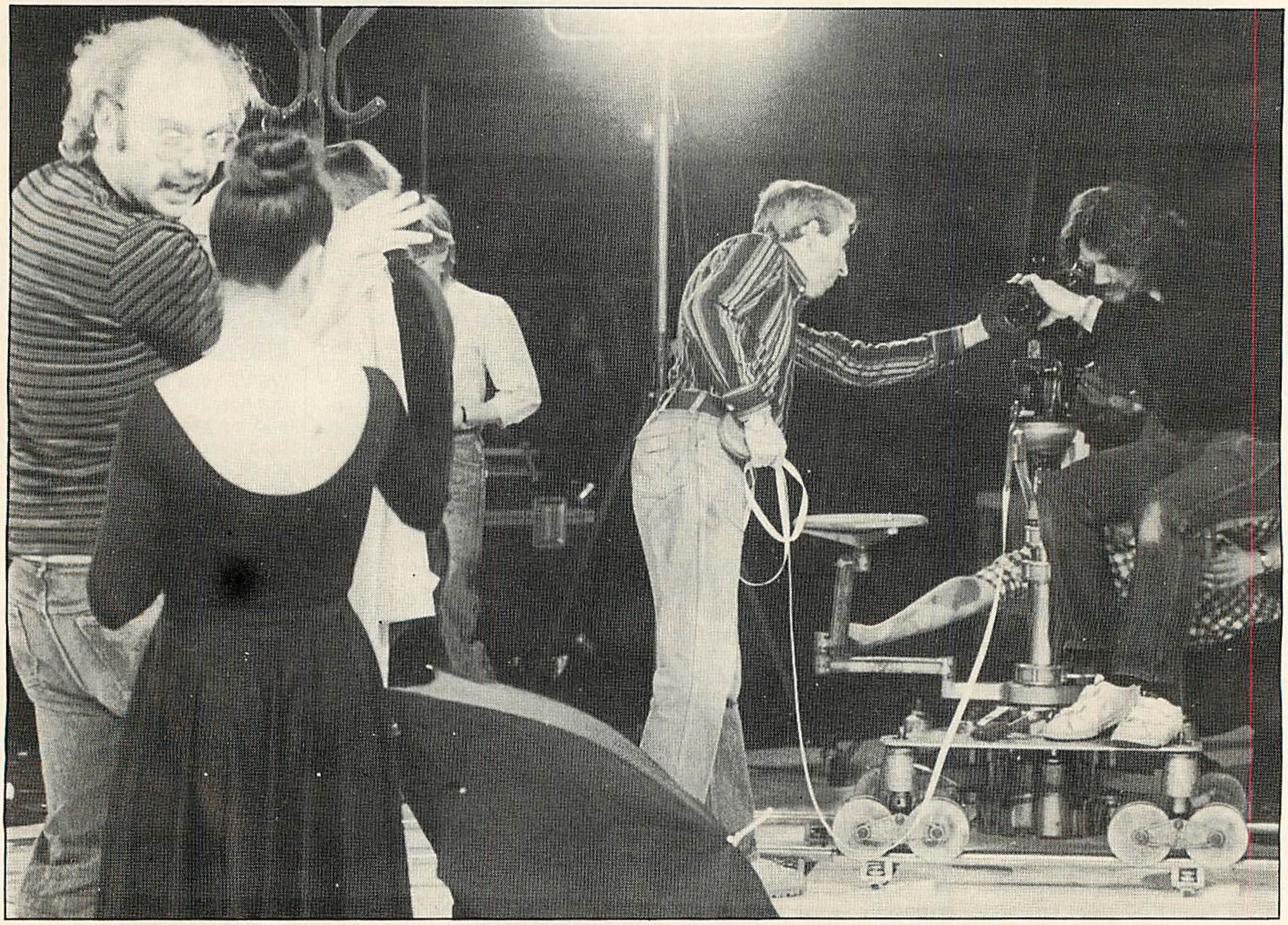
Ian Trackman is a name many readers will be familiar with. He worked as a consultant on The Computer Programme, Making the Most of the Micro, and the Micro Live Special. He produced many of the programs used in the series, some of which were released on cassette by BBC Soft. His latest release is the BBC Soft Toolbox.

In the days before the micro came along, Peter would sketch an outline storyboard and hand it over to a graphic artist. Nowadays, he takes the same rough sketches to Ian and they work out between them whether the idea's feasible or if there's a better way of doing it on the micro.

'Ian plays a major part at this stage', says Peter, 'because he's the one who knows what is and isn't possible. I don't know, and that's a good thing because it means my ideas aren't limited, and sometimes we do things you mightn't have thought possible on such an inexpensive computer.'

Once the pictures have been programmed, they are animated and filmed. The film is then edited, and certain sequences are speeded up, slowed down or chopped together.

So far the animations for *Science Topics*



Peter Bratt directs a sequence from 'Waves', one of the programmes in the Science Topics series, in Ealing Studios

have ranged from an explanation of the genetics of plant breeding to the propagation of sound waves. Sequences produced to explain the effect of electronic components in analogue and digital signals have worked particularly well, says Peter.

But the producer of *Science Topics* isn't blind to the major disadvantage of using the BBC micro for television work – the low resolution of the machine, even in the 'high resolution' graphics modes, and hence the crudeness of some of the images. 'We're not completely mad! Not by any stretch of the imagination could the BBC micro-generated graphics be compared to those produced by a mainframe system or a conventional animation artist.'

What lies behind the decision to use the micro is the intention to put out software packages for schools which will use the same graphics as the TV series. And with the Beeb going into so many schools, it was the obvious choice.

'Normally micros only appear on television in specialist computer programmes. And that's a great pity because the micro is no longer a temperamental piece of electronic wizardry reserved for the informed and committed expert.

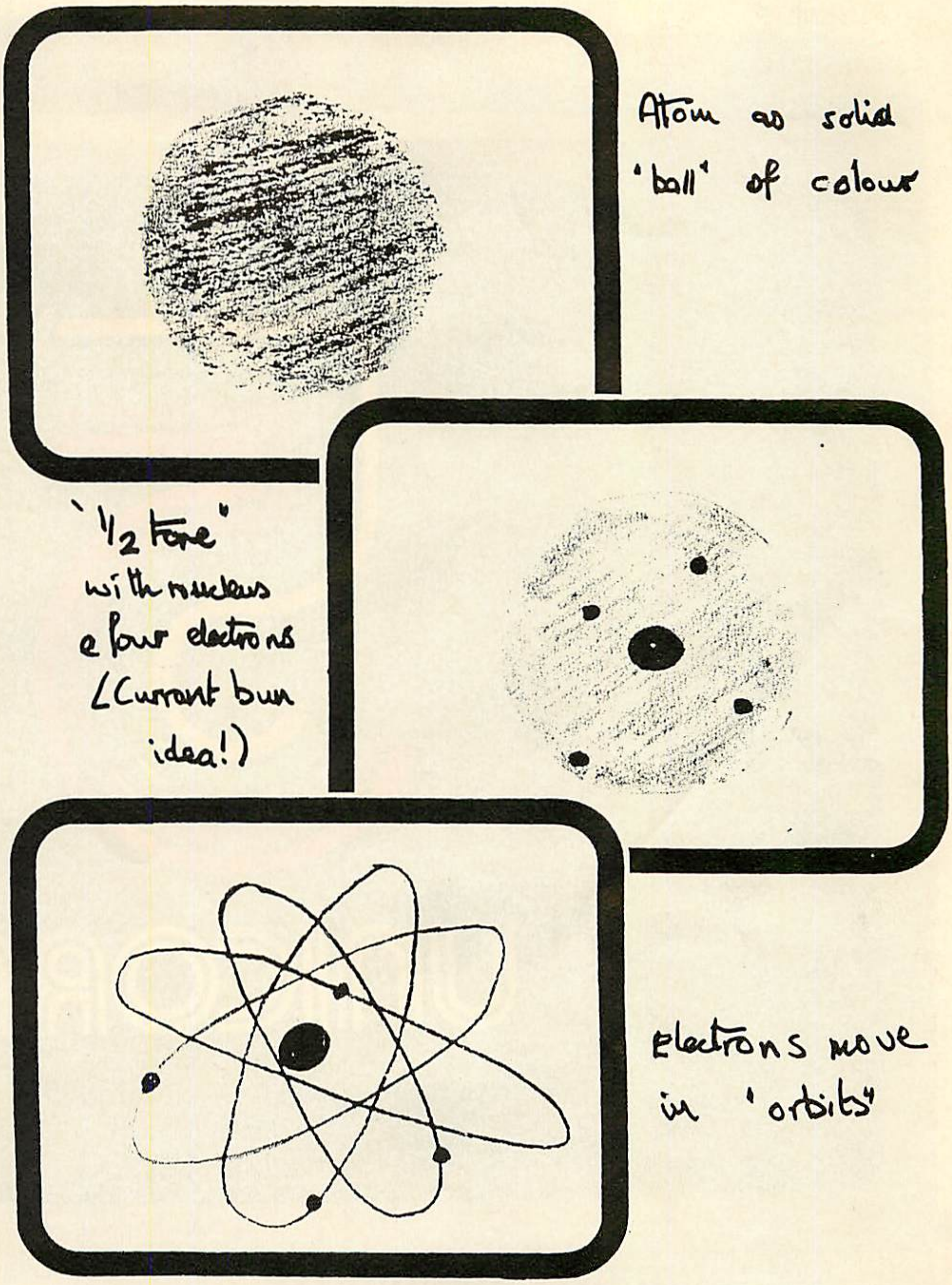
'We believe we are at the start of an age when the micro will take its place alongside bunsen burners and microscopes as a normal piece of school science equipment. Not that the TV series ever draws special attention to the computer. Rather than being something different, the computer is treated as another tool, to be used when appropriate.'

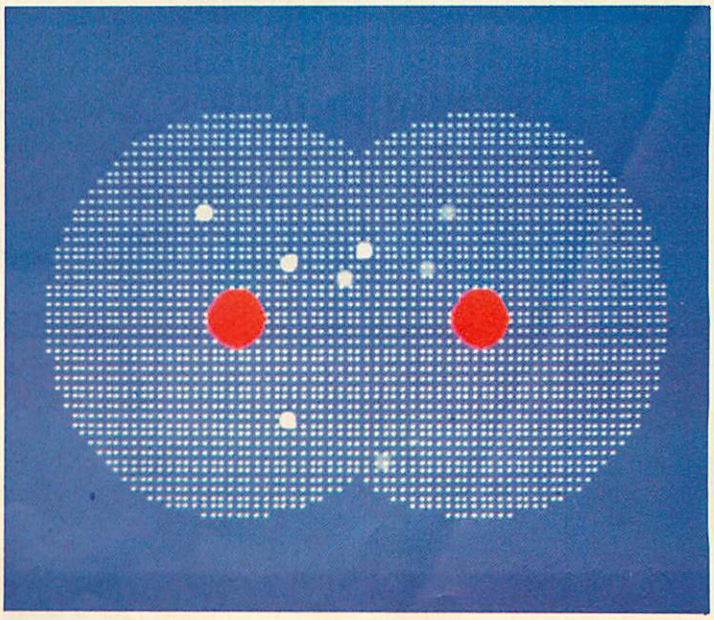
Using the BBC for graphics is part of this long-term project. The next step is to discover whether video discs could play a role. Peter is looking into whether edited versions of the television series on video disc could be controlled by a micro. That, however, would require extra filming, and hence extra costs, which his present budgets don't allow. But he's hopeful of convincing the Corporation to part with the cash, or for sponsorship from an outside source.

Software to accompany *Science Topics* is already being written at Chelsea College in London. Work on the packages started last autumn and the first fruits are expected for the new school year. Peter came into contact with the College while doing a course there and went back to them with the idea. But it wasn't all a foregone conclusion. 'When we started filming, we took a bit of a gamble in planning the micro graphics and the idea of the software as financing hadn't been worked out with BBC Publications, but it paid off in the end.'

Ten software packs are planned to accompany the series on subjects such as waves, chemical bonding, ecology and electronics – not to mention 'Newton and the Space Shuttle'. But Peter is particularly excited about this one as it puts pupils at *the helm* of a Nasa Shuttle to experience Newton's laws of motion for themselves.

page 23 ▶





Above: three stages in Peter Bratt's storyboard for an episode of Science Topics on atomic bonding, and right, a shot from the finished TV graphics


5
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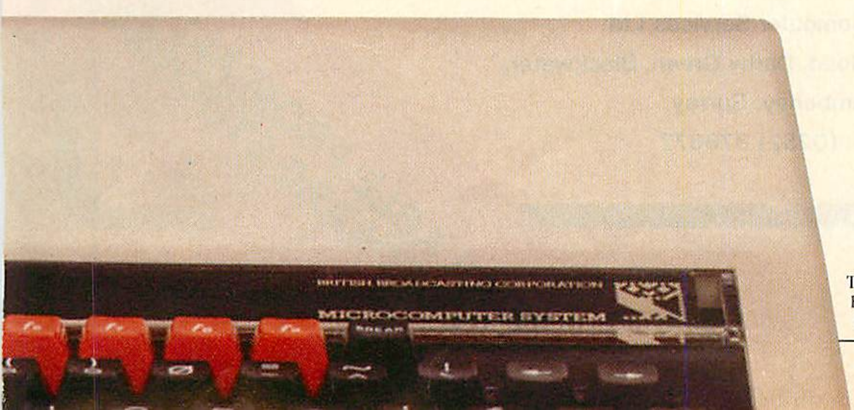
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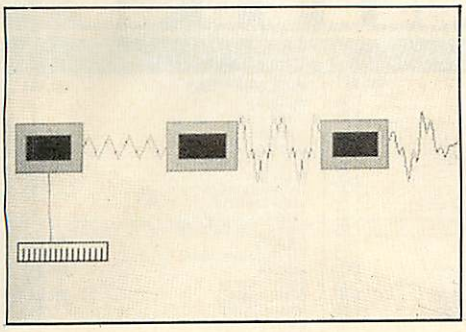
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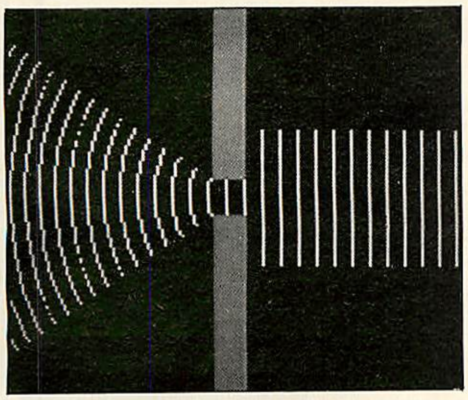


Text and Graphics provided by BBC Model B.
Keyboard provided by BBC Model B.
Disc interfaces are necessary for use with the Unicorn range.

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Ripple tank graphics - far less merry than playing around with water, and, below, how an electric organ works by altering the shape of the sound waves



Other packs use World Health Organisation statistics and models, with a few Lisa-type icon screens thrown in, and another is based on a nature conservatory in Devon.

The object of the software is to get pupils to think for themselves, which Peter believes is important. 'Computers in classrooms help to promote genuine problem-solving rather than rote learning of facts. In the long run it might be seen that the development of problem-solving skills is the biggest benefit of the computer revolution.'

And the combined use of television and software could be a big factor in stimulating pupils. Peter explains: 'Pupils watching a television programme about malaria might well feel strongly about the plight of the children in the African village. How much better the learning becomes if afterwards they can go to the computer and take part in a simulation where they become the malaria control officer in that African village.

As the graphics have become more demanding on *Science Topics*, so the Beeb's, and Ian Trackman's, talents have been stretched. A development version of the 6502 second processor came to the rescue, however, and *Science Topics* hopes other advances, such as the Aries and Solidisk boards, will have a role to play.



Ballerina Nina Falaise is deaf, but is able to sense the music through vibrations

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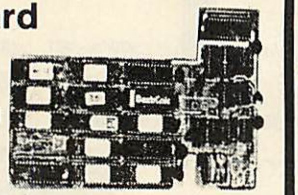
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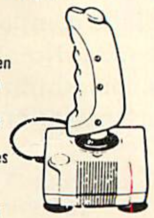
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□ *Acorn User* is not distributed in Canada, except by subscription, but there are a considerable number of Atom enthusiasts out there. To assist them, there is the Atom Users Group of **Canada**. It claims members from the Atlantic to the Pacific and from the frozen North down to the Caribbean.

The group publishes its own quarterly newsletter and is building up a software library. Subscription details are available from John Wood at the address below.

□ We've had a letter from the **Irish** Amateur Computer Club, now in its second year. The club has more than 100 members and a variety of micros are represented – there's a BBC user group within the club and it would like to hear from other BBC users in Ireland. The club caters for both city and provinces, with monthly meetings in Dublin and regular newsletters to members. New members should contact Austin Vaughan at the address below.

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CASH IN ON REGISTERS

Screen scrolling, slicing up screens, dissolving graphics – it's all possible and Ken Worrall shows how

THE Motorola MC6845 cathode ray tube controller (CRTC) with the BBC 'micro's video ULA form the system which puts the display on your TV or monitor. The 6845 contains 18 registers, 14 of which are write-only registers, two are read or write registers and two are read-only registers.

There are two main ways to write to one of these registers:.

1. VDU23,0,register,value,0,0,0,0,0,0 or VDU23;register,value;0;0;0
2. ?&FE00=register:?&FE01=value

The second method is more direct, and shows the way the chip is accessed: it is also easier to remember without all those noughts and commas in the VDU command.

There is, however, only one way to read a register:

?&FE00=register:PRINT?&FE01

Next we have a brief description of the 18 registers and some examples of what can be achieved by altering some of the values.

Register 0: This eight-bit, write-only register contains the total number of displayed and undisplayed character cells in each mode,, minus one for horizontal timing purposes:

Mode	0	1	2	3	4	5	6	7
Value	127	127	127	127	63	63	63	63

Program 1 shows how altering the value of register 0 can cause the display to dissolve and reform.

Register 1: This carries eight bits, and can only be written to. It contains the number of displayed character cells per horizontal line, for each screen resolution:

Mode	0	1	2	3	4	5	6	7
Value	80	80	80	80	40	40	40	40

You will notice that the number of displayed character cells is not equal to the number of displayed characters in the four and 16 colour modes. This is because of the memory used by colour; each character is made up of two or four character cells.

Program 2 demonstrates how altering the value of register 1 can be used to slice up and reform the display.

Register 2: Again an eight-bit write-only register, which determines the position of the sync pulse on the horizontal line.

Mode	0	1	2	3	4	5	6	7
Value	98	98	98	98	49	49	49	51

Register 3: This determines the width of the horizontal and vertical sync pulse:

Mode	0	1	2	3	4	5	6	7
Value	40	40	40	40	36	36	36	36

Register 4: This one uses seven bits and is also write-only. It holds the integer number of vertical character line times, to determine the vertical sync:

Mode	0	1	2	3	4	5	6	7
Value	38	38	38	30	38	38	30	30

Register 5: A five-bit write-only register containing the fraction to be used with register 4 to provide an exact frequency for the vertical refresh rate:

Mode	0	1	2	3	4	5	6	7
Value	0	0	0	2	0	0	2	2

Register 6: This seven-bit, write-only register stores the number of displayed vertical characters:

Mode	0	1	2	3	4	5	6	7
Value	32	32	32	25	32	32	25	25

Register 7: This seven-bit, write-only register determines the position of the vertical sync:

Mode	0	1	2	3	4	5	6	7
Value	34	34	34	27	34	34	27	27

Register 8: Interlace and blanking are governed by this write-only register using eight bits. The lower two bits control the interlace:

0 . . . No interlace
1 . . . Interlaced sync
3 . . . No interlace
4 . . . Interlaced sync and video

Modes 0-6 are interlaced sync only and mode 7 is interlaced sync and video. The high six bits control the video blanking and are only used in mode 7 when bits 5 and 8 are set.

Mode	0	1	2	3	4	5	6	7
Value	1	1	1	1	1	1	1	147

Register 9: A five-bit, write-only register which determines the number of vertical scan lines, including spaces, minus one per character.

Mode	0	1	2	3	4	5	6	7
Value	7	7	7	9	7	7	9	18

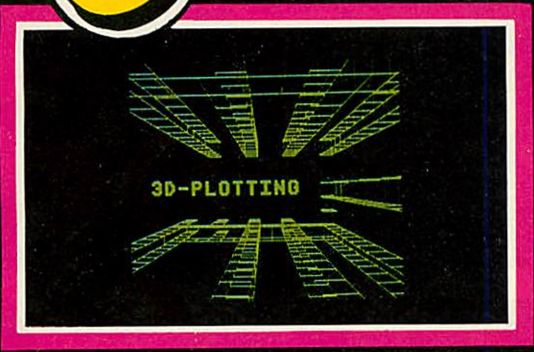
Register 10: Seven bits this time for a write-only register controlling the cursor size and flash rate. The lower five bits (0-4)

Program 1. Alters register 0

```
10 MODE5:value=63:REM Set value for each
mode.ie. 0-3=127,4-7=63
20 FORX=0TO1279 STEP10
30 MOVE 640,0
40 DRAWX,1027
50 NEXT
70 PRINTTAB(5,15)"ACORN USER"
80 X=1
90 Z=value
100 REPEAT
110 ?&FE00=0:?&FE01=Z
120 IF Z=0 X=-1
130 IF Z=value X=1:VDU7:FORC=0TO5000:NEXT
140 Z=Z-X
150 UNTIL0
```

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determine on which scan line the cursor starts (scan lines as set by register 9). If bit 6 is set (+64) the cursor will flash. With bit 5 set (+32), the cursor flashes slowly, otherwise it will flash quickly. If bit 5 is set and bit 6 is not, the cursor will be invisible. For example, in mode 7:

Mode 7	18	No flash
	18+32=50	Cursor invisible
	18+64=82	Fast flash
	18+96=114	Slow flash (normal setting)

Mode	0	1	2	3	4	5	6	7
Value	103	103	103	103	103	103	103	114

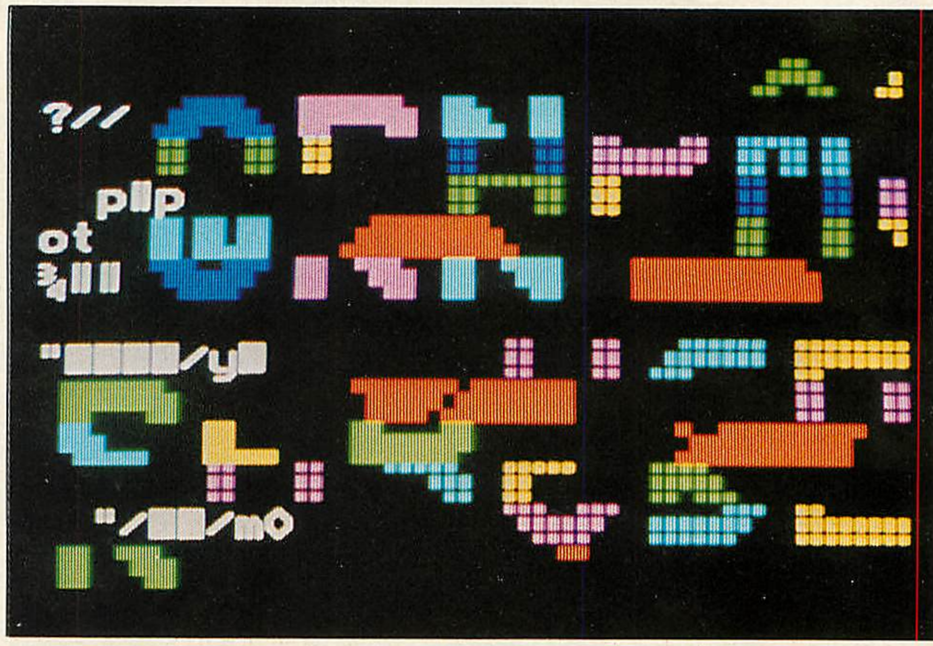
Register 11: This five-bit, write-only register determines on which scan line the cursor ends. For example:

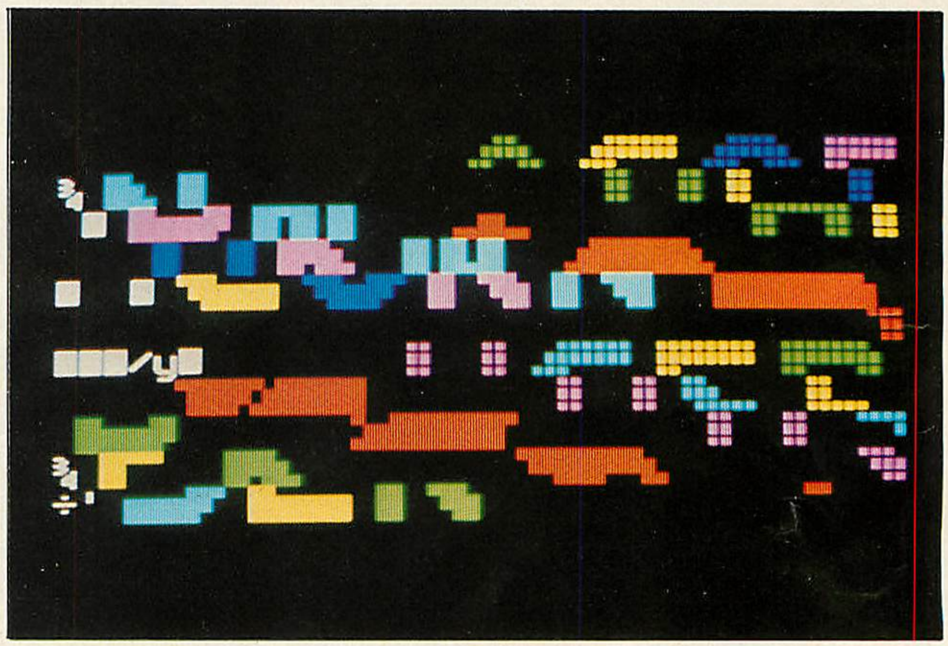
Mode 7	Register 10	96+0=96
	Register 11	9=9

This will give a cursor starting on line 0 and ending at line 9; therefore the cursor will occupy the top half of the character. Its values are:

Mode	0	1	2	3	4	5	6	7
Value	8	8	8	9	8	8	9	19

Registers 12 and 13: These two combined form a 14-bit, write-only register. Register 12 contains the lower eight bits and its partner contains the high six bits. In modes 0-6, this 14-bit combination contains the screen start address divided by eight. In mode 7, register 12 contains the high byte of the screen start address minus &74 and EOR'ed with &20; register 13



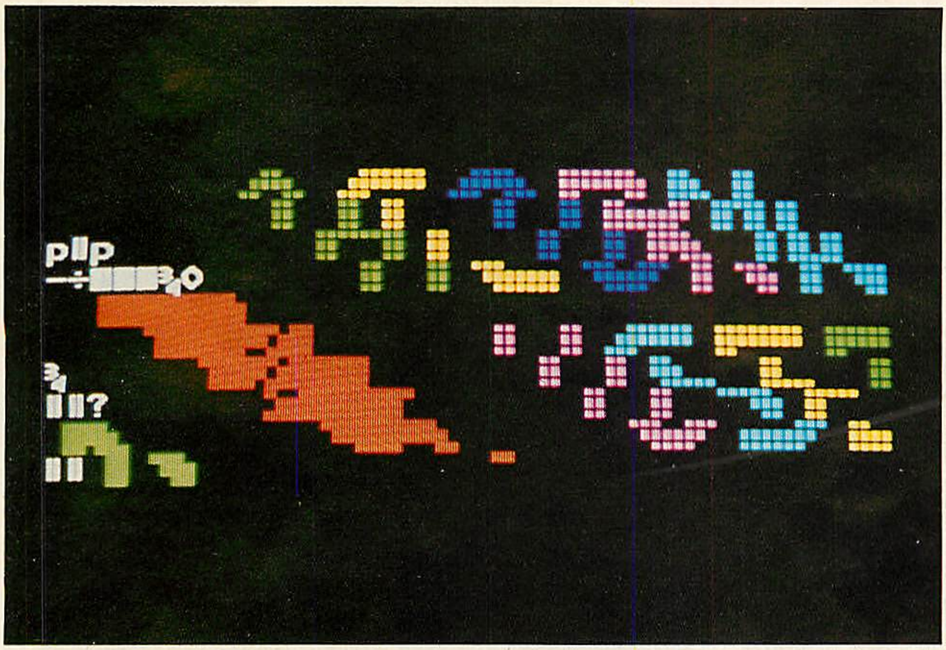


Program 2. Register 1 slices up display

```
   10 MODE5:value=40:REM Set value
for each mode.ie. 0-3=80 4-7=40
   20 ?&FE00=1:?&FE01=0
   30 MOVE100,100
   40 DRAW100,927
   50 DRAW1179,927
   60 DRAW1179,100
   70 DRAW100,100
   80 PRINTTAB(5,15)"ACORN USER"
   90 FORX=0TO value
  100 ?&FE00=1:?&FE01=X
  110 FORZ=0TO100:NEXT
  120 SOUND1,-15,X,1
  130 NEXT
```

Program 3. Cursor keys will scroll screen. Removes lines 170 and 180 to look at zero page or OS

```
   10 MODE5:screenstart=&5800:
screenend=&8000:char=40:
REM Change to suit mode
   20 size=screenend-screenstart
   30 *FX4,1
   40 MOVE100,100
   50 DRAW100,927
   60 DRAW1179,927
   70 DRAW1179,100
   80 DRAW100,100
   90 PRINTTAB(5,15)"ACORN USER"
  100 S=screenstart/8
  110 REPEAT
  120 X=INKEY(0)
  130 IFX=136 S=S+1
```





contains the unmodified low byte. These registers can be used to scroll the screen in any direction.

Program 3 demonstrates the use of these registers; by using the cursor keys the screen will scroll in any direction. If lines 170 and 180 are removed the screen will no longer wrap around and the screen can be moved down to look at zero page, or up to look at the operating system.

Program 3a is a mode 7 version of program 3. It is not possible to obtain full screen wrap-around in mode 7 as the screen ends at &7FE7 while the screen memory ends at &7FFF. This gives 24 unwanted bytes which offset the screen when trying to wrap around.

Registers 14 & 15: These two form a 14-bit read or write register. Register 14 contains the lower eight bits, and register 15 the high six bits. In modes 0-6 this 14-bit register contains the cursor address divided by eight. In mode 7 the high byte is stored in the same format as register 12.

Registers 16 & 17: This combination forms a 14-bit, read-only register which is used to read the lightpen input signal. (For further details on using this register, see *Acorn User* March '83.)

The registers 0-11 have preset values, as listed, which are stored in ROM:

Mode	
0-2	&C46E – &C479
3	&C47A – &C485
4-5	&C486 – &C491
6	&C492 – &C49D
7	&C49E – &C4A9

Program 4 shows this in the form of a table.

```
140 IFX=137 S=S-1
150 IFX=138 S=S-char
160 IFX=139 S=S+char
170 IFS>=screenend/8 S=S-size/8
180 IFS<screenstart/8 S=S+size/8
190 ?&FE00=12:?&FE01=(S DIV256)
200 ?&FE00=13:?&FE01=(S MOD256)
210 UNTIL0
```

Program 3a. In mode 7, full screen wrap-around is not possible

```
10 MODE7
20 *FX4,1
80 PRINTTAB(11,12)"ACORN USER"
90 S=&7C00
100 REPEAT
110 X=INKEY(0)
120 IFX=136 S=S+1
130 IFX=137 S=S-1
140 IFX=138 S=S-40
150 IFX=139 S=S+40
160 W=((S DIV256)-&74)EOR&20
180 ?&FE00=12:?&FE01=W
190 ?&FE00=13:?&FE01=(S MOD256)
200 UNTIL0
```

Program 4. Gives preset values of registers 0 to 11 as stored in ROM

```
10 MODE7
20 @%=6
30 PRINT''''"        Mode..0-2
3     4-5     6      7"'
40 FORX=0TO11
50 PRINTX,X?&C46E,X?&C47A,X?&
C486,X?&C492,X?&C49E
60 NEXT
```

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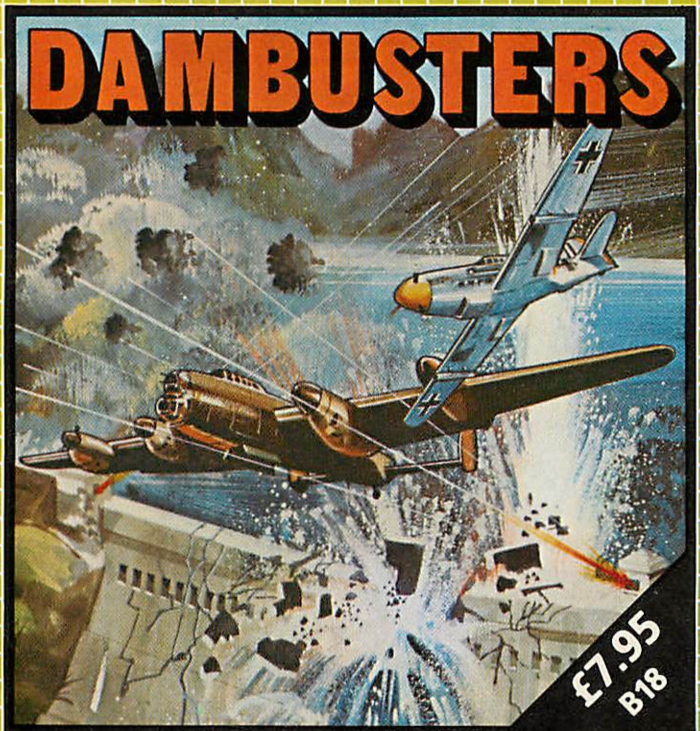
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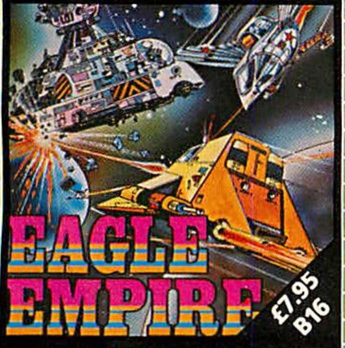
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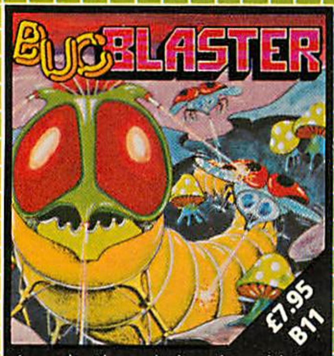
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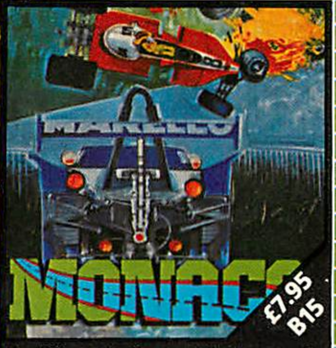
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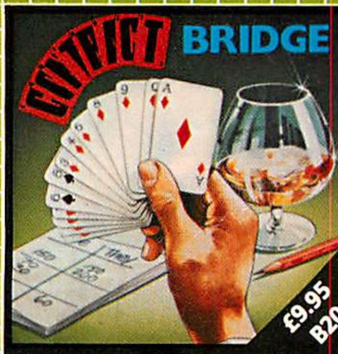
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FUTURE FILING

The existence of a second generation of Acorn filing systems for the BBC micro has just come to light. Charles Schaeffer introduces the concept of hierarchies of information common to all the new filing systems, and later issues will detail their structure and operation

MOST people will agree that the present disc filing systems for the BBC micro cannot exactly be described as sophisticated, and in the long term Acorn will no doubt do something about them. A version two of Econet will be launched with the 6502 second processor that will be the first advanced filing system (AFS). Then there's the long-awaited double density disc drives which will no doubt need an AFS (though it's anybody's guess as to exactly when). This series of articles will describe these developments under the umbrella of 'advanced filing systems', a name chosen because most of these filing systems are radically different and much more powerful than those BBC micro users are used to. It is worth noting that all this information is equally applicable to the Electron, as and when the peripherals become available.

A filing system is designed to control the storage and retrieval of programs and data. To organise this, a central concept in all the AFS's is the idea of hierarchies of data. The idea of a hierarchy exists in a primitive form in the DFS, where the single letter 'qualifier' can be used to subdivide the files on the disc into chunks, each of which is represented by a unique letter. The advanced filing systems extend this concept to provide a file storage system which may be arbitrarily subdivided into named blocks, called 'directories', each of which may be subdivided into further directories. At each level of the hierarchy files may exist along with directories, and the familiar *CAT command will display the catalogue of files and directories at a selected level. These names are provided exclusively by, and for, the user's convenience, and most have no meaning to the computer at all (the exceptions will be examined later).

This sort of file structure can be represented as an upside-down 'tree' (figure 1). At the top of the tree is a directory known as the 'root' and represented in Acorn filing systems by the symbol '$' (see Stan Froco's article on trees in the August 1983 issue for details). In figure 1 the root directory contains entries for subdirectories JOHN, JIM and JEREMY. Directory JOHN in turn contains a directory called BASIC (presumably used to store John's Basic files). To specify a directory or file, a string is used known as the 'pathname'. Each item of the pathname is a point on the tree, and the items are separated by a full-stop ('.') which is pronounced 'dot'. Thus the full pathname for the file PROG1 is $.JOHN.BASIC.PROG1 (pronounced 'dollar dot john dot basic dot prog1). To catalogue a directory the pathname is placed after the command, ie:

*CAT $.JOHN.BASIC <CR>

Note that attempting to catalogue a file is not allowed and will produce an error, eg:

*CAT $.JIM.LISP.PROG3

produces the message 'Not found'.

When the user starts a session using an AFS, the system provides an initial directory in which to work. With disc systems this is the root directory, but with Econet it depends on a number of factors (to be discussed next month). This initial directory becomes the currently selected directory (CSD): a simple *CAT will produce a catalogue of that directory, and when using the CSD filenames may be specified without the full pathname; eg if the CSD is $.JOHN.BASIC then CHAIN"PROG1" is all that is required to load and run PROG1. Note, however, that you may still specify a full pathname to bypass the CSD, so CHAIN"$.JOHN.BASIC.PROG1" has exactly the same effect.

The user may change the CSD by means of the *DIR command. For example

*DIR $.JIM.LISP

selects $.JIM.LISP as the new CSD. The command *DIR on its own makes the CSD the 'initial directory', that is the directory which is the CSD when the user starts using the system. There is a disadvantage to this filing system structure, however: if the CSD is $.JIM then *DIR LISP is valid (because it is a subdirectory of $.JIM) but *DIR JEREMY is not because it implies movement 'up' the tree (see figure 1). This can be overcome using the full pathname (beginning with '$') or in some filing systems by using an explicit command to move up the tree.

The limit to how long (and complex) a pathname can get, and therefore how many files can be stored, is set by the amount of space on the medium for directory information, rather than being preset as it is in the original DFS: no 31 files limit in an AFS! ●

Next month: Econet level one.

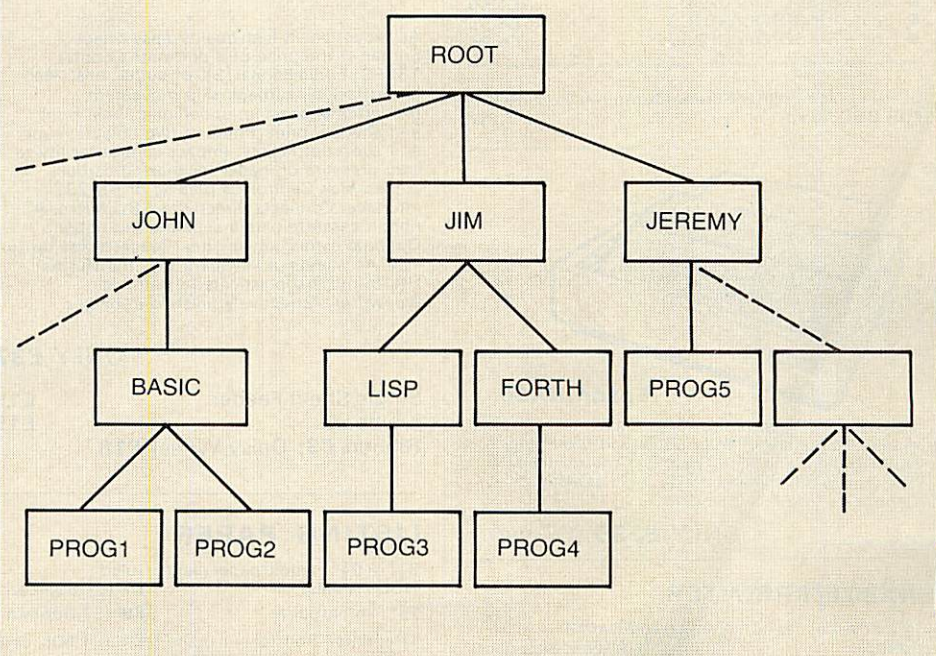
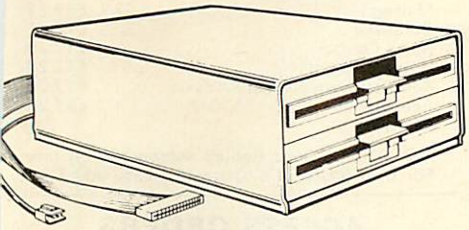


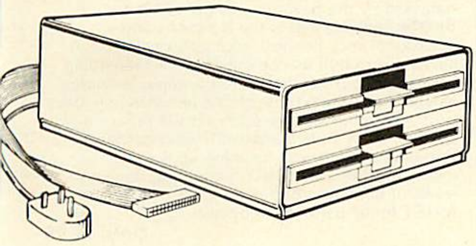
Figure 1. Hierarchical file structure or 'tree'

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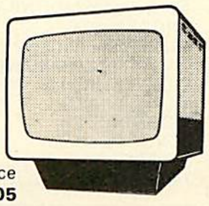
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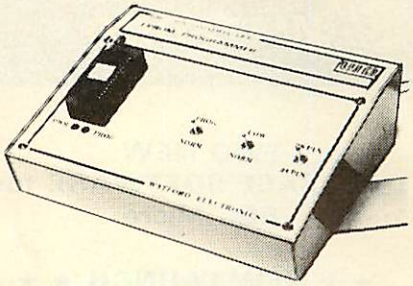
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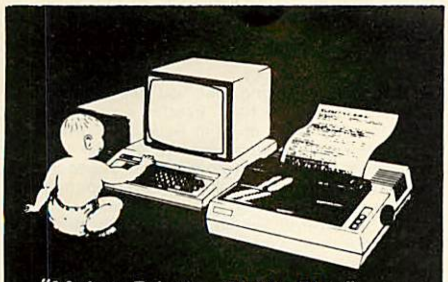
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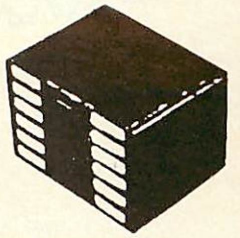
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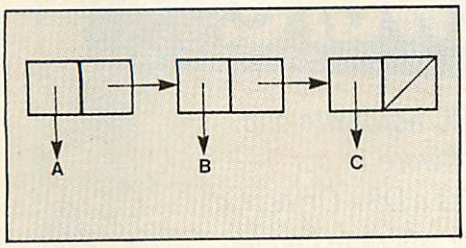
LITTLE BOXES

In the second of his three-part series on learning Lisp Stan Froco explains how lists – and thus Lisp programs – are represented in the computer

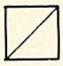
WE CAN represent lists using simple box diagrams. For example, the list

(A B C)

is drawn as



Each both has two halves the first pointing to the item in the list, the second to the rest of the list. The symbol



is used to represent a pointer to nowhere, signifying the end of the list.

These boxes represent the computer's memory, each box representing four bytes in two two-byte halves. Suppose this list were somewhere in the computer's memory, say at address 5000.

5000	5008	5016
5004	5024	0000
5008	'A' 0	0 0
5012	'B' 0	0 0
5016	5012	5004
5020		
5024	'C' 0	0 0

This shows the first box occupying bytes 5000 to 5003. The first two bytes are a pointer to the textual item 'A'. A pointer is just the address in memory of the thing *being* pointed to (5008 in this case). Byte 5008 holds the character 'A' (ie, its ASCII code 65). Since it is convenient to use memory in blocks of four bytes, the next three bytes are padded out with zero. Bytes 5002 and 5003 comprise the second half of the first box and hold a pointer to the rest of the list (at byte 5016). The structure is as for the first box.

When we come to the third box (at byte 5004) we see that its second half holds zero, corresponding to a pointer to nowhere (it wouldn't be sensible to put lists in zero page, which is used by the operating system etc). This pointer to nowhere is given the name NIL. We have come across this before as being the same as the empty list

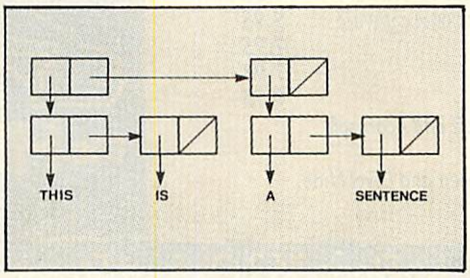
()

and this seems a sensible item to use as end-of-list marker. An important thing to notice is that the order of boxes in memory is irrelevant, and many other combinations are possible. The structure is all given by the values of the pointers.

This is a slightly simplified representation of the mechanism used by most Lisp systems. The subtle differences between this and the actual implementation will be covered in the last article (they're not particularly relevant at this stage). The role of the Lisp system is to provide the necessary facilities for handling these lists in memory. We can build arbitrary lists using our box notation – for example, a list of lists

((THIS IS) (A SENTENCE))

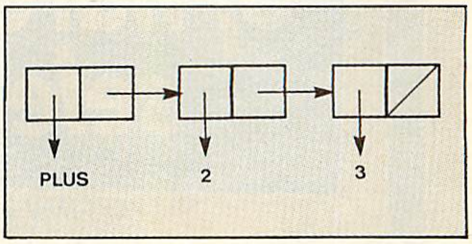
would be drawn as



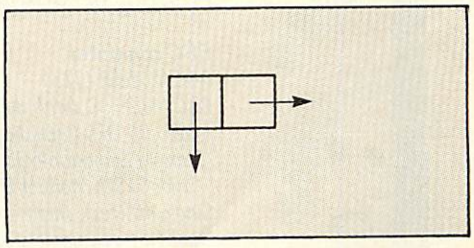
Similarly, function evaluations such as

(PLUS 2 3)

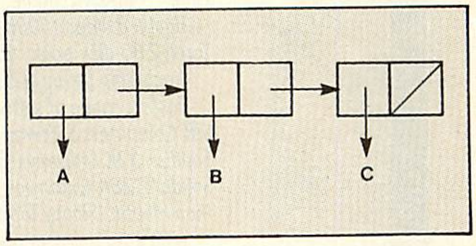
are represented as:



We can examine the action of CAR, CDR and CONS on box structures. If we give CAR a box

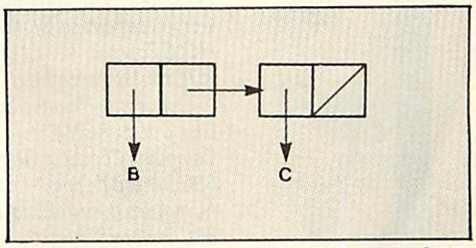


CAR will return the thing pointed to by the left half. For example, CAR applied to



would give us the textual item A.

Similarly CDR gives the item pointed to by the right half, in this case the list



The reason for the strange names of CAR and CDR is related to this. The IBM 709, one of the first machines on which Lisp was implemented, had 36-bit memory words, which it used in two 18-bit halves for Lisp boxes. These words could be loaded into a pair of registers in the machine, the Address and Decrement registers. CAR was short for *C*ontents of *A*ddress *R*egister and CDR was short for *C*ontents of *D*ecrement *R*egister. These strange names have stuck.

CONS is the opposite of the above. Every time CONS is called it creates a new four-byte box, or *cell*, from the remaining memory (I will discuss what happens when

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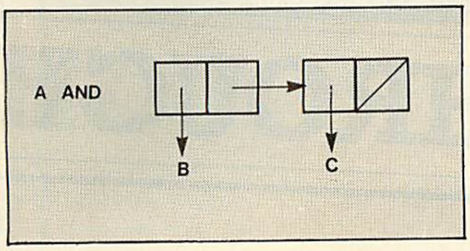
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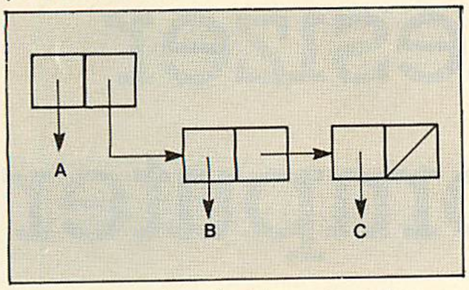
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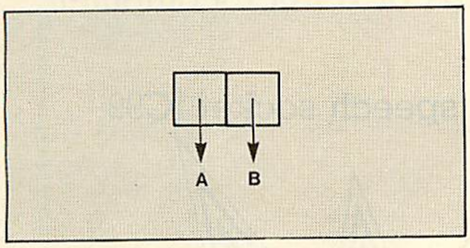
Lisp runs out of memory in the next article), and points the left half to its first argument and the right half to its second argument. Thus CONS applied to



yields a new cell



You may wonder what happens when we apply CONS to two textual items such as A and B. Not surprisingly we get:



We have a problem here in that we know how to print out structures only where the second half is another list or NIL. The above structure is called a *dotted pair* and is printed out or entered as:

(A . B)

A list is just a special type of dotted pair. We could write

(A B C)

as

(A . (B . (C . NIL)))

If you draw them you will see that the box structures are the same. Lists are so common, however, that the first notation is used, being shorter.

Most Lisp functions that return new list structures (as opposed to functions like CAR and CDR which return bits of existing list structures) call CONS internally to create the new structure. This means that you can get several different copies of something which looks the same. When you use the predicate EQ to test for equality you must beware of this. EQ checks whether structures are the same thing, not whether they look the same. Thus

```
(SETQ A (LIST X Y Z))
(SETQ B (LIST X Y Z))
(EQ A B)
```

will return NIL.

We need to look at what items can be held as values by Lisp variables. There are the following in Acornsoft Lisp:

Numbers
Textual items
Built-in functions not defined in LISP

Lists
Other structures based on dotted pairs

The last two items are special and are grouped together as *S-expressions*. They have the property that they can be split by using CAR and CDR and created by using CONS.

The first three items are grouped together as *atoms*. Atom comes from the Greek *atomos* meaning not divisible, and atoms cannot be split by CAR and CDR (and of course can't be constructed using CONS). Lisp keeps a list of all known atoms, called the *Object list*. The function OBLIST will create a list from this of all character atoms (the correct term for textual items) being used as variable names. This of course includes all functions, built-in functions having as value a function atom which, among other things, gives the execution address of the function.

Every time a function returns a new atom it first looks for it on the object list. If it is already there then the function just returns a pointer to it, otherwise it puts the new atom on the object list, and returns a pointer to it. Thus there is only ever one copy of an atom. This is why

```
(SETQ A 'X)
(SETQ B 'X)
(EQ A B)
```

returns true. Both A and B point to the same character atom X. This is the fundamental difference between S-expressions and atoms.

It should be pointed out that in practice to look up number atoms all the time on the object list would be inefficient. Lisp systems may have several different copies of a number, but the comparison routines know this, and if it is a number they check the value, rather than the place on the object list. Thus the way number atoms differ is not seen by the user.

'Notice that the order of the boxes in memory is not important'

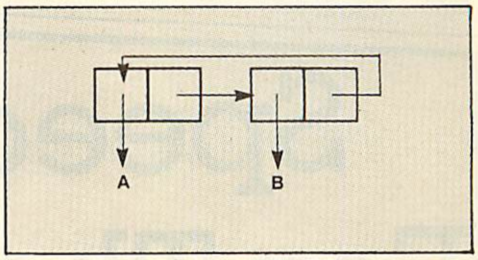
Two functions modify an existing data structure (as opposed to creating a new one by an internal call to CONS). These are RPLACA and RPLACD (for *replace CAR* and *replace CDR*), which alter the CAR and CDR parts respectively of their arguments. Thus

```
(SETQ X '(A B))
(RPLACA X 'Z)
```

will leave X with the value (Z B). This can be used to create circular lists:

```
(SETQ X '(A B))
(RPLACD (CDR X) X)
```

X has the box structure



If you give this to the PRINTC routine you will find it prints an infinite list of As and Bs. Like most Lisp functions, it assumes lists are not circular, and keeps on printing until it comes to a NIL.

You may have noticed that the ' mark is the only time something in Lisp is not expressed as a function. This is in fact not the case and ' is short for the function QUOTE.

'A

is shorthand for

(QUOTE A)

QUOTE just returns its argument unevaluated. There are a number of built-in functions which don't evaluate their arguments. We have already seen one, SETQ, which doesn't evaluate its first argument, but uses it as a variable name. There is a function SET which does evaluate its first argument. Thus

(SETQ A 10)

and

(SET 'A 10)

are identical. SETQ (an abbreviation of SETQUOTE) is so useful that it is built in.

There are a number of characters which are useful but difficult to print out. These include:

( ) space . carriage return

We have seen the use of the variable BLANK to incorporate spaces into text, and there are corresponding variables (LPAR, RPAR, PERIOD and CR) for the other characters. There is, however, an easier way. If you want to use a special character in a character atom just precede it by an exclamation mark, and its usual effect will be overriden. For example:

```
(PRINTC 'The! cat! sat! on! the! mat)
(PRINTC '!(brackets!))
```

To get an exclamation mark use !!

The function PRINT (as opposed to PRINTC) will print out items putting exclamation marks before these special charac-

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ters. PRINTC is short for *PRINT C*haracters, ie, no extra exclamation marks.

PRINT and PRINTC always put a carriage return at the end of each line. If you don't want this use PRIN or PRINC.

There are a number of corresponding routines to write to and read from files on disc, tape and so on. Files are opened for reading by

(OPEN filename T)

and writing by

(OPEN filename NIL)

OPEN returns a number as result, which is a file handle. This must be used whenever writing to, reading from or closing the file. To read a Lisp expression from a file use:

(READ handle)

READ without a handle reads from the keyboard. To write to a file use WRITE or WRITE0, which correspond to PRINTC and PRINC. They take as their first argument a handle, with the rest of the arguments as for PRINTC and PRINC.

These provide a useful way of saving and loading routines back in without destroying the whole image, as happens when LOAD is used.

If you define a function in Lisp and print it out you find it is printed out in the minimum possible space. It would be better if it were neatly displayed, as with the examples I have given. The layout doesn't alter the meaning of the function but makes it easier to understand. The Lisp superprinter SPRINT is supplied as a built-in function defined in Lisp. Every time a new level of bracket nesting is encountered the printing is indented three more spaces. Where possible, everything is printed on one line, otherwise vertically downwards.

A slightly better version is given in Norman and Cattell's *LISP on the BBC Microcomputer* (Acornsoft). A good way to find out how it works is to use

(SPRINT SPRINT)

to print it out. You will see it uses two functions, XTAB and CHARCOUNT, to print

'Functions defined in Lisp are printed out in the minimum possible space'

out spaces at the beginning of lines and to work out how much space is left on the line. CHARCOUNT uses a variable LINEWIDTH to work out the number of characters allowed per line (it should be one less than the maximum allowed). This is initially 31 (for compatibility with Atom Lisp) but can be sensibly altered to 19 for modes 2 and 5, 39 for modes 1, 4, 6 and 7, and 79 for modes 0 and 3.

I do not propose to describe SPRINT in detail. When you get to the end of this article you should be able to understand how it works. It is anyway described in the appendix to *LISP on the BBC Microcomputer*.

SPRINT uses three new functions, LOOP, UNTIL and WHILE. Strictly speaking, you do not need the equivalent of FOR...NEXT and REPEAT...UNTIL loops in Lisp. A loop can always be replaced by recursion (put the loop into a separate function; at the end of the function make a recursive call to the function – this is equivalent to jumping to the beginning of the loop).

Early Lisp systems did not have loops, but they were soon added as a convenient and natural way of programming. The loop function has the form

```
(LOOP
   (function-call1)
   (function-call2)
      . .
      . .
      . .
   (function-calln))
```

Every function call is executed in turn until the end of the loop is reached, when execution returns to the first function call and they are all executed again. This is repeated ad infinitum.

The loop function is useful only if you can get out of the loop. For this there are the UNTIL and WHILE functions, which can be used inside a loop. The UNTIL function has the form:

(UNTIL condition expression expression . . .)

There may be any number of expressions for evaluation. If the condition is false nothing happens, NIL is returned as value. If the condition is true, then each expression is evaluated, and the loop containing the UNTIL is terminated. The value of the last expression is returned as the value of the loop function (NIL if there are no expressions).

The WHILE function is identical except that the loop is terminated when the condition is false. The following calculates the squares of numbers from 1 to 20:

```
(SETQ n 1)
(LOOP
  (PRINTC n BLANK (TIMES n n))
  (UNTIL (GREATERP (SETQ n (ADD1
                               n)) 20)
    (PRINTC 'All! done)))
```

Last month I rather skated over the problem of how to edit Lisp functions after you've defined them. A good Lisp programmer rarely defines functions that are more than ten lines long, and so retyping is a feasible method of editing. However, Acornsoft Lisp provides a rather more elegant editor, EDIT, defined in Lisp.

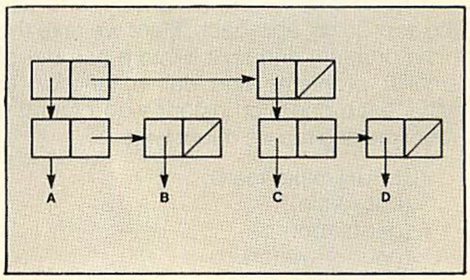
EDIT allows you to modify values of variables. In particular I explained last month how functions were variables with values which are lists of the form:

(LAMBDA (argument list) body of function)

EDIT allows you to modify lists by stepping along them and changing bits. To use it let us consider a variable BILL whose value is the list

((A B) (C D))

or in box notation



If we now use

(EDIT BILL)

we get BILL superprinted out and we can use a number of commands to modify it. At any stage we can see where we are by hitting return.

If we want to modify a part of BILL we can use A or D to select the CAR or CDR part. After we have finished editing the part we can use B to go back to where we were before. If we wanted to edit the sublist (A B) of BILL we could enter A followed by return and we would get printed

(A B)

We have three options for modifying the current sublist. We can use X to chop the first item off a list. In this case we would get:

(B)

That is, the current list has been replaced by its CDR. We can now use C to CONS an item onto the front of the list. For example if we now use

C
(X Y)

we would CONS the list (X Y) onto the list (B) and get:

((X Y) B)

Finally, we can use R to replace the whole item, so if we used DA to get

B

as the current item, followed by

R
Z

we would get Z as the current item. Using B to go back to where we were (undoing the last A) would give us:

(Z)

Another B (undoing the D) would give us:

((X Y) Z)

Another B (undoing the first A) would give us:

```
(((X Y) Z) (C D))
```

And a final B would take us out of the editor, leaving BILL with the value

```
(((X Y) Z) (C D))
```

Try experimenting – it takes some getting used to.

I said earlier that good Lisp programmers don't write functions of more than ten lines (at least, not very often). What is a good way to write Lisp programs?

A good way for big programs is to use the 'top-down' approach. Here we take the main problem and split it into a number of smaller problems and call a function to solve each one. For instance, to control a robot making tea we might write:

```
(DEFUN make-tea ()
  (boil-kettle)
  (get-teapot)
  (pour-on-water)
  (wait-minutes 5))
```

We could then write each of these functions in terms of smaller functions, for example:

```
(DEFUN wait-minutes (n)
  (LOOP
    (wait-one-minute)
    (SETQ n (SUB1 n))
    (UNTIL (ZEROP n))))
```

and so on. We can test the logic at any stage by making any incomplete functions just print out their name and arguments when called. We can then check the main function or any of its sub-functions to see if the right things are printed out.

The alternative approach is 'bottom-up' programming, often appropriate for small programs. Here we write a number of useful small functions and bolt them together into bigger functions. A typical example is in games programming, where you start by writing a set of functions to move shapes round the screen, flash colours and so on.

Almost all programmers use a combination of both styles. My example below does. You have to find the right approach for yourself.

One rule to follow whatever your style is *Keep your functions small.* If it takes more than about ten lines it's probably better split into several functions. You can help keep things clear by giving your functions long names that explain what they do. This helps make up for the absence of a commenting facility in Acornsoft Lisp.

Mainframe Lisp systems rarely worry what size numbers grow to. To put a limit on the size of numbers is an annoying recognition of the limitations of real computers, and inevitably hampers portability. The best solution is to hide the problem inside the Lisp system.

Acornsoft Lisp allows only numbers in the range -32768 to 32767. This package, closely based on the one in *LISP on the BBC Microcomputer*, implements mainframe style unlimited arithmetic.

One way of representing numbers would be as a list of digits. For example a million would be

```
(1 0 0 0 0 0 0)
```

The scheme used here is almost the same, with three differences

1. Digits are to base 100, ie, the components of the list are in the range 0 to 99 rather than 0 to 9. This speeds things up.
2. Numbers are stored back-to-front to make carry and borrow operations simpler.
3. Numbers less than 100 are stored without any list structure as ordinary numbers. Numbers up to 9999 are then stored as a dotted pair. For example 1234 is
   (34 . 12)
   Larger numbers are stored as lists with a dotted pair at the end. For example, a million is
   (0 0 0 . 1)

'We write a number of small functions and bolt them together'

First a routine to print out big numbers

```
(DEFUN big-print (n)
  (COND
    ((NUMBERP n) (PRINC n))
    (T (big-print (CDR n))
      (print-two-digits (CAR n)))) )
```

which uses

```
(DEFUN print-two-digits (n)
  (PRINC (QUOTIENT n 10)
  (REMAINDER n 10)))
```

print-two-digits ensures numbers are always printed with two digits. If we didn't do this then numbers such as a million would be printed out as

```
1000
```

Next, a number to convert ordinary numbers to big number representation:

```
(DEFUN big-number (n)
  (COND
    ((LESSP n 100) n)
    (T (CONS
      (REMAINDER n 100)
      (big-number
                (QUOTIENT n 100))))))
```

Now to add numbers.

```
(DEFUN big-plus (a b)
  (COND
    ((NUMBERP a) (small-plus-big a b))
    ((NUMBERP b) (small-plus-big b a))
    (T (join-digit
      (PLUS (CAR a) (CAR b))
      (big-plus (CDR a) (CDR b)))) ))
```

and

```
(DEFUN small-plus-big (a b)
  (COND
    ((NUMBERP b) (big-number (PLUS a
    b)))
    (T (join-digit
      (PLUS a (CAR b))
      (CDR b)))) )
```

Notice that small-plus-big also adds two small numbers. Join-digit is used to add a small number to the least significant end of a large number, propagating a carry if the number is greater than 99. Its definition is:

```
(DEFUN join-digit (n a)
  (COND
    ((LESSP n 100) (CONS n a))
    (T (CONS
      (REMAINDER n 100)
      (small-plus-big
        (QUOTIENT n 100)
        a)))) )
```

Multiplication requires another group of routines that are very similar:

```
(DEFUN big-times (a b)
  (COND
    ((NUMBERP a) (small-times-big a b))
    ((NUMBERP b) (small-times-big b a))
    (T (big-plus
      (small-times-big (CAR b) a)
      (CONS O (big-times a (CDR b)))) )))
```

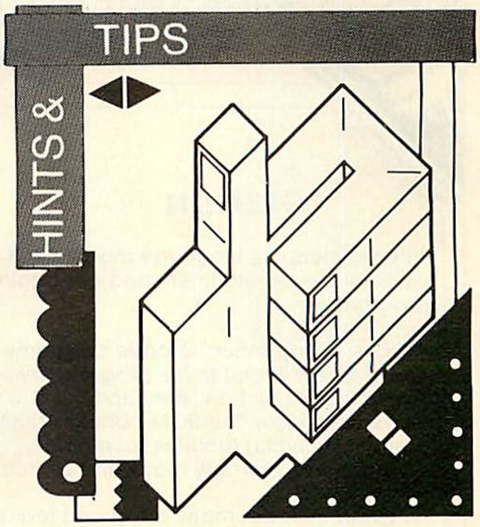
Note the use of (CONS O...) to align digits correctly for the addition.

```
(DEFUN small-times-big (a b)
  (COND
    ((NUMBERP b) (big-number (TIMES
    a b)))
    (T (join-digit
      (TIMES a (CAR b))
      (small-times-big a (CDR b)))) ))
```

This completes the multiplication routines. You can extend this set of routines to your heart's content. *LISP on the BBC Microcomputer* shows how to raise one number to the power of another by repeated multiplication.

One routine that is difficult is division. Consult a book on computer arithmetic, such as D E Knuth *The Art of Computer Programming – Volume 2: Semi-numerical Algorithms*, published by Addison-Wesley. If you start building in subtraction you will have to work out a way of representing negative numbers. As it stands the system only handles positive numbers.

Next month in the concluding article I'll cover one or two remaining features of Lisp and take a look at some of the uses to which the language has been put. I'll also consider one or two of the languages that have evolved from Lisp. The last part of the article will present a simple computer-aided design system which takes advantage of the BBC micro's graphics. ●



THESE problem pages, presented each month by Martin Phillips, offer simple hints and tips and answer queries from readers concerning the BBC micro and Electron and BBC Basic. If your letter is published you earn £5 for your trouble!

If you have a query on some technical hitch or a worrisome aspect of programming, please supply full details and make your question specific. It is not enough just to say that you are getting the error message 'No room' or 'Dim space' – there are, of course, a number of reasons why a program will run out of memory. A diagnosis can be made only with full information on the program, the style of programming, the techniques employed, whether discs or Econet are being used, and so on. Include a listing where appropriate.

We cannot reply to letters individually, nor can we return listings.

Write to: Hints & Tips, Acorn User, 68 Long Acre, London WC2E 9JH.

SOFTWARE: DO WE HAVE THE RIGHT OF ACCESS?

THIS month Mr G Smith wins £5 for a problem to which I can give no solution, but is worth airing. His letter concerns tapes which have been 'locked' or otherwise made difficult to copy, and makes the following points:

- Some publishers offer to replace uncopiable tapes which become unreadable, but many do not.
- Several adverts have appeared for software which claim to copy protected tapes and discs.
- The *Advanced User Guide* explains what a 'locked' tape is and therefore enables such tapes to be unlocked by an experienced user.
- Magazines have shown methods for bypassing program protection.

Mr Smith concludes that the purchaser of a locked tape who has limited experience will be unable to take a back-up copy or make his own modifications – but ways round this are readily available at a price. Hence the more inexperienced computer users are at a disadvantage.

Although software piracy costs the publisher a considerable amount of money, I agree with the sentiments expressed by Mr Smith. Some software houses are now going to ridiculous lengths to prevent copying. One notable educational software house now breaks programs up into as many as 20 parts, some only one byte long! Not content with that, they have altered the cassette loading mechanism halfway through the program, making it even more difficult to load.

Before Christmas I gave a lecture to a group of 40 teachers on using the BBC micro in science. I decided to include a demonstration of one of the programs from this software house (produced in conjunction with an education authority). For ease and speed I normally use discs during a lecture, but these programs were available only on cassette, and this particular program could not be transferred to disc. To cut a long story short, when I wanted to show the program it proved exceptionally difficult to load, mostly because the cassette filing system had been altered. Not only did this put 40 teachers off that particular software, but it started me thinking along similar lines to Mr Smith.

As well as the points he raises I would like to raise others on behalf of all those BBC users who have bought, or are planning to buy, programs that will not copy. I will talk in the context of educational programs, although many of the points have a wider concern.

First, will software houses replace any faulty tape if a back-up copy cannot be made, even if the damage is not their fault? If so, is this clearly stated, or will cassettes be changed only if enough fuss is made?

Second, what happens to those uncopiable cassette programs if a disc drive is later purchased? Will the publisher refund the cost of the tape against a disc version?

Is an establishment expected to purchase both a disc and cassette version if it has a mixture of disc and tape machines and needs the program to be used on either?

How much extra does the purchaser pay for all the programming involved in making the program difficult to copy?

Having bought the software, usually without seeing it first, why should users not be able to alter it to their requirements?

An establishment is forced to either purchase a copy for every machine that wants to use the software simultaneously or load each machine one after the other. If it is expected that a copy is purchased for each machine then doesn't the Econet system break the copyright law?

All the protection devices slow down loading – this can even double the time taken.

The use of many small programs to prevent the whole program being copied makes loading tedious, and any failure to load means the process has to be started all over again.

Many users find programs recorded on their own cassettes will load more reliably. This cannot be done with an uncopiable tape.

And all this fancy protection does not prevent copying by the simplest and quickest method; tape-to-tape. No one has successfully found a method of preventing this method, although the quality of the copy is degraded. I prefer the attitude adopted by publishers such as Longmans, which writes its programs in Basic and advises users to make a back-up, at the same time pointing out why it is detrimental to the user's interests to make illegal copies.

For those software houses who prefer to put their efforts into producing uncopiable programs, might I suggest that if they reduced the price of their wares then the incentive to copy them would be much reduced. Why should a computer tape be so much more expensive than an audio tape?

HOW TO TACKLE BLOCKS

NO DOUBT readers will have come across the 'Header?', 'Data?' or 'Block?' messages when trying to load a program from cassette. Unlike most error messages, it is not clear what these are trying to indicate. To understand what they mean you have to know how the computer stores programs on tape.

Imagine a book of short stories. This is equivalent to a tape with several programs stored in it. For convenience the book is split into small parts called pages, each of which is numbered. A program is also split up into small parts called blocks, and each of these is numbered (the computer counts

in hexadecimal, based on 16 rather than base 10, and starts counting at 0). Play a tape without the computer lead plugged in and listen to the sound. There is a single tone called the 'leader' followed by a series of buzzing noises, each of which lasts about three seconds. Each separate buzzing noise is a block. The computer keeps a note of the block it has just read and will give a 'Block?' message if the next block it reads is not the one it was expecting.

At the top of a page you often find the name of the story printed as well as the page number. The computer always saves the title and block number at the start of each block, together with a check of the number of bits. This information is contained in what is called the 'header'. If the computer is unable to read the header correctly then 'Header?' is printed.

Below the title and page number in a book comes part of the story itself written in words and sentences. This is equivalent to the commands, statements and lines that make up a program and is called data. Once the computer has read a block of data it uses the checksum given in the header to make sure it has read the data correctly. If not, the 'Data?' message appears followed by the message 'Rewind tape'. You need to rewind only to the start of that block and not to the start of the program.

THE EQUALITY TEST

QUITE by chance when working on a number program for the speech synthesiser, I found a way of printing a more accurate result of a computation. In December's Hints & Tips I showed how the BBC micro had a routine to tidy up numbers and print them out with rounding off, which caused problems. By putting the result of a computation directly into a string using the STR$ statement, the exact number stored can be printed out. Using December's example, we can gain more insight into why the program would not work.

To refresh memories, the program is given again here (listing 3). One would expect it to print out 'Correct', but the computer does not take A+B to be the same as C. To see what the computer has done, try listing 4. On my machine with Basic 1, I get the following printout:

```
RUN
      A =.3
      B = 6.4
      C = 9.4
A+B−C = 3.7252903E-9
```

This method still does not give the complete picture of what is happening as the STR$ function uses the same binary-to-decimal conversion routines and works to the same precision as the PRINT statement (nine figures on Basic 1 and 10 figures on Basic II). This is why it prints out A, B and C correctly. It does, however, enable the difference between A+B and C to be shown. As can be seen, the difference is very small but is enough to fail the equality test.

```
10 REM Listing 3
20 A=3
30 B=6.4
40 C=9.4
50 IF A+B=C PRINT "Correct"
60 PRINT"I've finished"
```

Listing 3.

```
10 REM Listing 4
20 A=3
30 B=6.4
40 C=9.4
50 IF A+B=C PRINT"Correct"
60 A$=STR$(A)
70 B$=STR$(B)
80 C$=STR$(C)
90 D$=STR$(A+B-C)
100 PRINT"     A = "A$
110 PRINT"     B = "B$
120 PRINT"     C = "C$
130 PRINT"A+B-C = "D$
```

Listing 4.

WHEN ERROR REPORTS START MAKING MISTAKES

ERROR reporting on the BBC micro and Electron is usually very good – so much so that one tends to rely on it too much. It is not always precise, and cannot always be so. One example of this occurs when there are errors in data statements. The line at which the error is reported is the line where the read statement is, and not the data line. This can be confusing because the error is expected to be at the line given. A deliberate error has been induced in the data line of listing 1, and a 'No such variable at line 20' error is reported after correctly printing 1 3 5. The read statement expected to find a number and found a string instead.

Listing 2 shows a common error that can occur in data statements. A comma has been put at the end of line 50, and the computer expects to find another number on that line. The same error as the first example is reported. Similarly, extra commas put in other places in data lines will also cause errors:

50 DATA,1,3,5
or
50 DATA 1,3,,5

In these examples it is easy to spot the mistake, but when typing in listings with many lines of data it can be difficult. The only solution is to check all data lines carefully before running the program. If you are writing a program with data in it, keep each data line short; that way, listings are easier to check, and mistakes are easier to find. Also use the WIDTH command to set the screen display to the same length as, say, the magazine listing (*Acorn User* normally sets to 40 characters).

If using string variables in DATA statements, take care not to get any extra spaces either before or after the string. It is easy to overlook these and then wonder why the program does not work. If in any doubt, enclose the string in speech marks:

DATA "January", "February", "March"

```
10 REM listing 1
20 FOR N=1 TO 5
30 READ T
40 PRINT T
50 NEXT N
60 DATA 1,3,5,ERROR,9
```

Listing 1.

```
10 REM listing 2
20 FOR N=1 TO 5
30 READ T
40 PRINT T
50 NEXT N
60 DATA 1,3,5,
70 DATA 7,9
```

Listing 2.

COPYING MACHINE CODE PROGRAMS

JUSTIN DODSON of Hull is one of several readers who have asked how it is possible to copy machine code programs on the Electron. The method given here will work for both the Electron and the BBC and will also save data files. (It is assumed the reader is aware that it is illegal to copy programs subject to copyright.)

Instead of the normal loading method, the program to be copied is loaded into a specific memory area, and the *contents of that memory area* are saved, as opposed to saving an actual program. This is done with the *LOAD and *SAVE commands. To make a copy of a program called MYPROG, the following steps will need to be taken. First type *OPT1,2 and press Return. This switches on the *detailed information* about cassette loading and saving addresses. Now type *LOAD"MYPROG" 0E00 and press Return.

Insert the program to be copied into the cassette recorder and load in the normal

way. The reason '0E00' is put after the program name is to force the program to be loaded at 0E00, the start of the user's memory. This overrides the address given when the program was saved. Once the program has loaded, the prompt will reappear, and at the side of the program name four sets of hexadecimal numbers will appear. The first is the two-digit hexadecimal number that normally appears on loading and shows the block currently being loaded. The second number is a four-digit hexadecimal number and is the actual length of the program.

In figure 1, MYPROG has a length of &573 bytes. The third and fourth numbers are eight digit hexadecimal numbers, the first four digits of each are either '0000' or 'FFFF', and can be ignored. The last four digits of the third number is the execution address, and the last four digits of the fourth number is the reload address.

The execution address for MYPROG is &801F and the reload address is &1900.

The third step is to type *SAVE"MY PROG" 0E00 +0573 801F 1900 and press Return.

Insert a blank cassette in the player and save the program in the usual way. The four pieces of information that have been included after the program name are:

- start address of memory where the program is stored
- length of memory to be saved
- execution address (optional)
- reload address (optional)

If no reload address is given, it is assumed to be the same as the start-address of memory where the program is stored. Notice that both the *LOAD and *SAVE statements expect to be followed by hexadecimal numbers. The screen dump shows the steps taken to load MYPROG and then resave it. This method for saving areas of memory can be used to save parts of or all the screen memory in the same way and to load it in again. Hence a picture displayed on the screen can be saved, loaded back into the screen memory area and shown again. By using an area of memory that cannot be loaded with a program, such as the memory where the Basic ROM chip resides (&8000), a program can be verified without losing the original from memory. Once a program has been saved, reload it in again using the following command: *LOAD"" 8000. This will then try to load the program into the Basic ROM, and in the process it will check that the program will load correctly. If not, simply resave the program as the original program will not have been overwritten. It works for Basic and machine-code programs.

Figure 1.

```
BASIC

>*OPT1,2
>*LOAD"MYPROG" 0E00
Searching

Loading

MYPROG       05 0573      00001900 0000801F
>*SAVE"MYPROG" 0E00 +0573 801F 1900
RECORD then RETURN
MYPROG       05 0573      00001900 0000801F
```

THE CASE OF THE COMPULSORY 'THEN'

FOR most purposes the keyword THEN is an optional part of the IF ... THEN ... ELSE structure and is often left out of listings. However, there are occasions when it must be included, and there is a brief warning to this effect in the *User Guide* on page 363 when used with pseudo-variables such as TIME.

One not very obvious example where THEN must be used is if control passes to the machine operating system after the test condition. A machine operating system (MOS) call always starts with a '*'. Examples of MOS calls are *TAPE, *MOTOR, *FX, *CAT etc. A full list is given on page 416 of the *User Guide*.

To demonstrate the point, *MOTOR is used as an MOS call with an immediate and obvious effect: it turns the cassette motor relay and light on and off. Listing 5 will not work as intended, and comes up with a 'No such variable at line 30' error. This is because the asterisk is interpreted in this case as a multiply sign and the unknown variable is MOTOR0. The cure is simple: put the THEN in, as in listing 6.

```
10 REM listing 5
20 INPUT"Enter 0 OR 1 "N
30 IF N=0 *MOTOR0
40 IF N=1 *MOTOR1
50 GOTO 10
```

Listing 5.

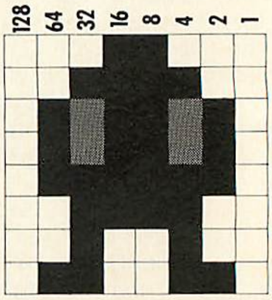
```
10 REM listing 6
20 INPUT"Enter 0 OR 1 "N
30 IF N=0 THEN *MOTOR0
40 IF N=1 THEN *MOTOR1
50 GOTO 10
```

Listing 6.

TWO-COLOUR CHARACTERS

NICHOLAS HORNE of Great Missenden has sent in a short routine to program multicoloured user-defined characters. One way to do this is to define a character for each colour and then superimpose them on each other. For example, take a small monster; if the body is coloured in red and the eyes are to be cyan then CHR$240 can be defined as the red part and CHR$241 as the cyan part.

Then the two characters can be included in a string, with the appropriate colour



changes included. This is done by using CHR$18+CHR$0+CHR$1 which is the same as GCOL0,1. To give the two coloured character the string will be:

C$=CHR$18+CHR$0+CHR$1
+CHR$240+CHR$8+CHR$18
+CHR$0+CHR$6+CHR$241

CHR$8 moves back one space to effectively overprint the first character. Normally this would erase the first character before drawing the new one, but if VDU5 is used, it enables one character to overwrite another without erasing the first. Hence the two-coloured character.

To add more life, the monster can be given flashing eyes by using colour 14 instead of colour 6. Listing 7 demonstrates how to program user-defined characters in two colours. By a similar technique it is possible to join several characters together. Also, more than two colours can be used at once. The four control codes which move one pixel in a specified direction are:

CHR$8 . . back one space
CHR$9 . . forward one space
CHR$10 . . cursor down one line
CHR$11 . . cursor up one line

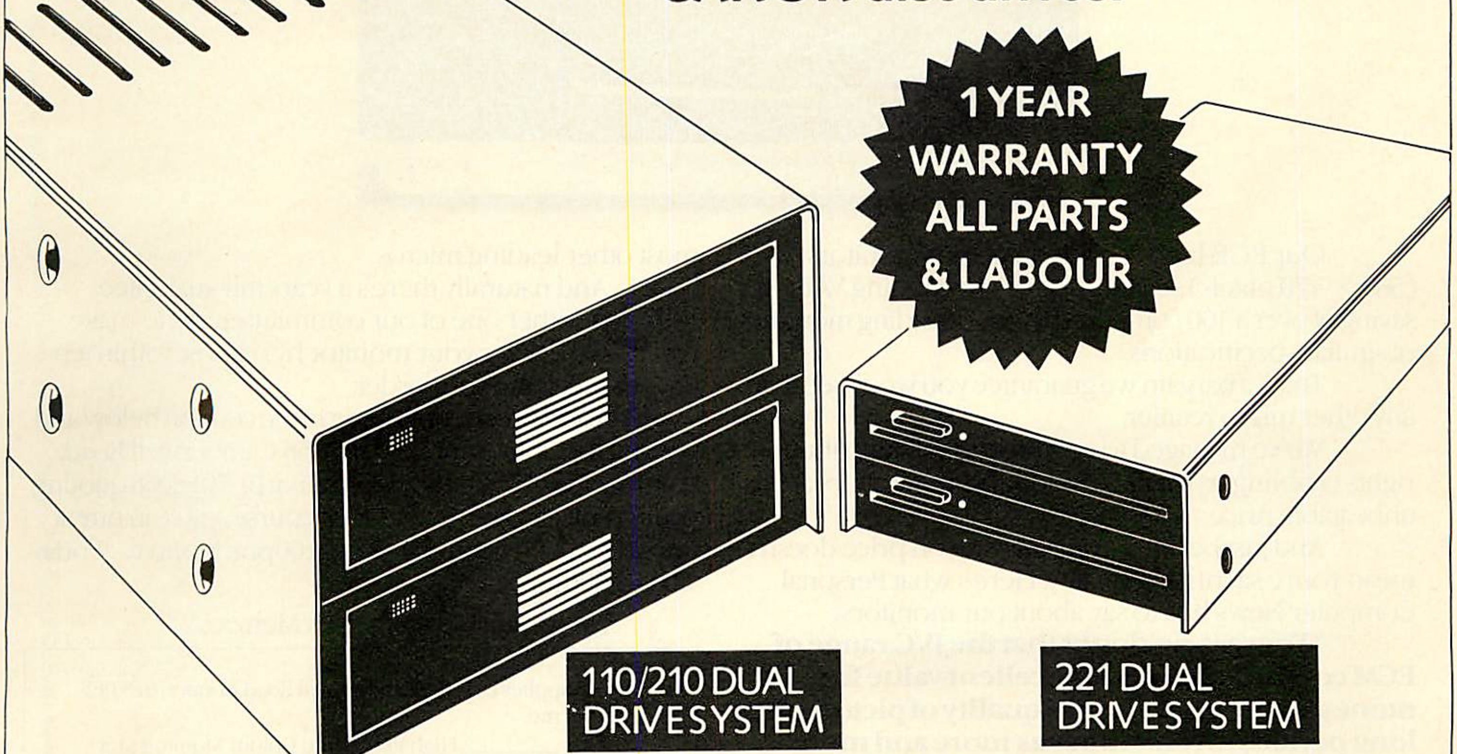
```
10 REM listing 7
20 MODE2
30 VDU5
40 VDU23,240,24,60,90,90,
126,60,36,102
50 VDU23,241,0,0,36,36,0,
0,0,0
60 C$=CHR$18+CHR$0+CHR$1+
CHR$240+CHR$8+CHR$18+CHR
$0+CHR$14+CHR$241
70 MOVE 640,512
80 PRINT C$
```

Listing 7.

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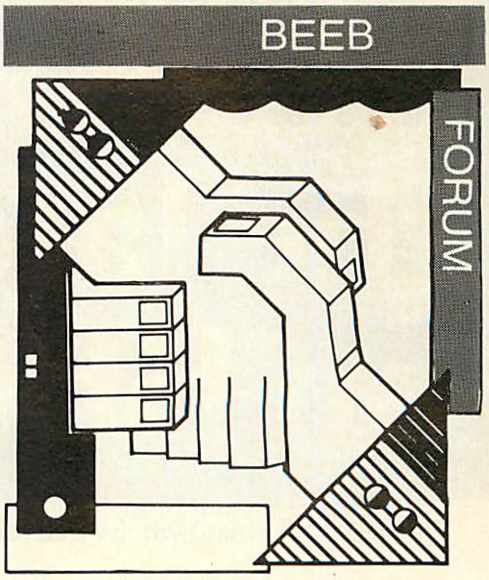
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AUTO-RUN A PROGRAM AT ANY ADDRESS

SEVERAL suggestions have been made for making Basic programs respond to the *RUN or *<*filename*> command. The most notable came from A Oliver in the October issue, and from Ben Clarke, who offered a complicated method of protection in the January issue. I have followed up Mr Oliver's suggestion, and I think removed many of its shortcomings.

His method consisted of embedding a piece of machine code in a REM, at the start of the program, which placed the characters RUN<CR> in the input buffer. This was operated by *SAVEing the resulting program with the execution address at &1906, the start of the REM code.

There are a number of drawbacks to this procedure. First, an unsightly and meaningless REM appears, with flashing characters (these result from the use of character 138 in the *FX138 call). Second, renumbering can upset the program. Third, it is restricted to auto-running at address &1900.

For the best use of the auto-run facility it should be possible to cause the program to run at *any* address, including those below the default setting of PAGE. This is particularly important, for instance, in my tape-to-disc copying program (March issue), which must run at &1100, and it is tedious to have to type PAGE=&1100 before every use and wasteful to have to have a separate loading program. It is also desirable to be able to auto-run 'loading' programs (which load and shift machine code or long Basic programs) at high addresses.

The machine-code add-on that accomplishes this will be more complicated and longer, so it is tacked on invisibly to the *end* of the Basic program.

Listing 1 works as follows. First the procedure PROCfiling_system uses OSARGS to determine the current filing system. If the tape filing system is in use, then OSARGS returns 1 or 2 in the accumulator, and this is extracted by ?user. If the disc filing system is operative then ?user is 4. (The other filing system numbers are detailed, along with the other OSARGS information, on page 454 of the *User Guide*.) The program is aborted if a system other than tape or disc is in operation.

The user is now asked what value of PAGE is required. The filing system determines the lowest usable value of PAGE. Impossibly low values are forbidden, but if you choose too high a value, hard luck!

Next the filename is obtained, and the required file is *LOADed into memory at the previously determined address. OSFILE is used to do this, as it leaves in the information block the length of the file. This value, when added to the value of PAGE, will give us the value of TOP for the Basic program. It is at this address that our extra code will be placed.

The characters for

PAGE=&<page><CR>OLD
<CR>RUN<CR>

are poked in at TOP. PROCassemble now adds, immediately above this, the code which will cause these characters to be inserted into the input buffer. This bit of code is rather complex, as both index registers are required in the OSBYTE call with A=138 and so cannot be used for counting. The OLD is necessary when PAGE is set below the default value. I found the appearance of the 'No room' message irritating. It made me feel like Alice at the Mad Hatter's tea party, saying: 'Don't be silly, there's *plenty* of room!'

The resulting program is *SAVED, again via OSFILE. The load address is the previous value of PAGE. The length is the original length plus &50 for the extra code. The execution address is the address of the 'start' of the code.

Finally, if successful, a little message is issued and you are returned to Basic. This is done by using *BASIC rather than END. The effect is to restore PAGE to its default value, among other things.

To use the program it needs to be loaded in at a high address, to prevent its being wiped out when the Basic program is *LOADed. This could be done by typing

PAGE=&7000<CR>
CHAIN"STARRUN"<CR>

But this is precisely what the program was designed to avoid. So as an example of how to use it, let's use it on itself.

Listing 1. Auto-run add-on for a Basic program

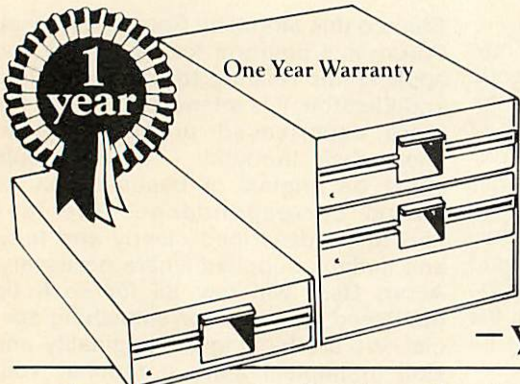
```
   10 REM TO AUTO-RUN A BASIC PROGRAM
   20 REM G.B.HILL NOVEMBER 1983
   30
   40 MODE7
   50 PRINT''"              STARRUN"''"
  G.B.Hill (c) 1983"''
   60 PROCsetup
   70 PROCfiling_system
   80 IF NOT (tape OR disc) THEN CLS:PRI
NT'"Unrecognised filing system":VDU7:GOT
O 240
   90 INPUT"Type in the hex address for
PAGE "P$
  100 IF LEFT$(P$,1)<>"&" THEN P$="&"+P$
  110 page=EVAL(P$)
  120 IF tape AND page<&B00 THEN PRINT'"
Too low. PAGE must be > &B00"':VDU7:GOT
O 90
  130 IF disc AND page<&1100 THEN PRINT'
"PAGE must be greater than &1100 or"'"
the DFS does not work."':VDU7:GOTO90
  140 INPUT'"Type in filename of the BAS
IC program "'filename$
  150 IF disc AND MID$(filename$,2,1)<>"
" THEN filename$="$."+filename$
  160 IF disc THEN n=9 ELSE n=10
  170 filename$=LEFT$(filename$,n)
  180 PROCload_file(filename$)
  190 top=page+block!10
  200 PROCassemble
  210 PROCsave_file(filename$)
  220 CLS
  230 PRINT'"Program ":filename$:" will
now auto-run"'"at address ":~page
  240 PRINT'"RETURNED TO ";
  250 *BASIC
  260
  270 DEFPROCsetup
  280 osfile=&FFDD
  290 osargs=&FFDA
  300 DIM block 17
  310 DIM name 9
  320 DIM user 3
  330 block?0=name MOD 256
  340 block?1=name DIV 256
  350 ENDPROC
  360
  370 DEFPROCload_file(F$)
  380 X%=block MOD 256
  390 Y%=block DIV 256
  400 $name=F$+CHR$13
  410 FOR I=2 TO 17
  420 block?I=0
  430 NEXT
  440 block!2=page
  450 A%=&FF
  460 CALLosfile
  470 ENDPROC
  480
  490 DEFPROCsave_file(F$)
  500 $name=F$+CHR$13
```

page 55▶

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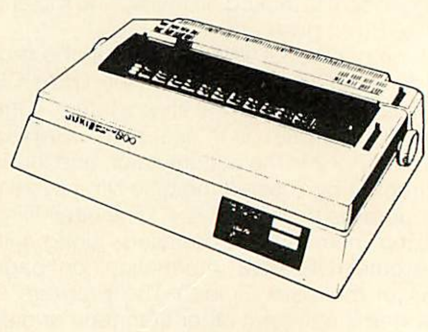
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- First type in the program, and save it under the name "STARRUN". If you are using discs, then save a backup copy under the name B.STARRUN or similar to avoid disastrous loss if you have made a typing error.
- Now CHAIN it (at the default setting of PAGE).
- Respond to the prompt for PAGE with 7000 (or &7000 – either will do).
- Respond to the prompt for filename with STARRUN.
- Hey presto! It's done.

To use the resulting program from disc, simply type

*STARRUN<CR>

and respond to the prompts. From tape, use the new version of the program and type

*RUN<CR>

and again respond to the prompts.

▶ from page 53

```
510 block!2=page
520 block!6=top+19
530 block!10=page
540 block!14=top+&50
550 A%=0
560 CALLosfile
570 ENDPROC
580
590 DEFPROCfiling_system
600 X%=&80
610 Y%=0
620 A%=0
630 !user=USRosargs
640 tape=(?user=1 OR ?user=2)
650 disc=(?user=4)
660 ENDPROC
670
680 DEFPROCassemble
690 $top="PAGE="+P$+CHR$13+"OLD"+CHR$1
3+"RUN"+CHR$13
700 zerop=&80
710 limit=&83
720 counter=&84
730 FOR opt=0 TO 2 STEP 2
740 P%=top+19
750 [OPT opt
760 .start                  lda #top MOD 256
770                         sta zerop
780                         lda #top DIV 256
790                         sta zerop+1
800                         lda #19
810                         sta limit
820                         lda #0
830                         sta counter
840 .loop                   ldy counter
\to put chars in input buffer
850                         lda (zerop),Y
860                         tay
870                         lda #138
\ready for osbyte
880                         ldx #0
890                         jsr &FFF4
\osbyte to insert into keyboard buffer
900                         inc counter
910                         lda counter
920                         cmp limit
930                         bne loop
940 .end                    rts
950 ]
960 NEXT
970 ENDPROC
>
```

£5 ROUTINE RESCUE

by Jamie Stephenson

THE purpose of this RECOVER routine (listing 2) is to recover Basic programs after a 'Bad Program' message has been returned. It must have happened to all BBC programmers at times, resulting in the frustrating and time-consuming job of re-keying or even reinventing your program.

RECOVER has been made deliberately short – less than one page – so that it can be loaded without overwriting the original program. All the user has to do is type in:

PAGE=&D00
CHAIN"RECOVER"

Once loaded, the program prompts for the start address of the 'Bad Program', this can be keyed in hex (eg, &E00). The routine then reads the Basic lines of the program, attempting to bridge the faulty lines so that the Basic interpreter can once again read the program. This is achieved by checking that a RETURN character is to be found at the start of each line of Basic. If it does not exist, a search is made for the next RETURN character and the line-length adjusted accordingly. The routine stops when either the end of the program is reached or when a RETURN character cannot be found. In the latter case an end-of-program marker is inserted. Finally, the variable PAGE is updated.

Though any corruption of the program cannot be undone, the program can be listed, preferably in mode 7, in case any control codes have been introduced. Corrections can then be made to restore the program to its former glory. Note that the routine uses PAGE &D00 and so is only suitable for cassette machines.

```
10 REM PARAMETERS :
20 REM        A$     PAGE value
30 REM        A%     Pointer to current line
40 REM        ?A%    13 if line found
50 REM        A%?1   line number high byte
60 REM        A%?2   line number low byte
70 REM        A%?3   line length
80 REM        B%     Pointer to next line
90 REM Input PAGE value in hex
100 INPUT A$
110 A% = EVAL(A$)
120 REM Start of program = 13
130 ?A% = 13
140 VDU14
150 PRINT "PAGE = &"; ~A%
160 REM End of program found?
170 IF A%?1 > 127 PRINT "End OK" : GOTO420
180 REM Print line number & hex address
190 PRINT A%?1 * 256 + A%?2, ~A%
200 REM Is line length invalid?
210 IF A%?3 < 4 GOTO 280
220 REM Move pointer to start of new line
230 REM and check line present
240 B% = A% + A%?3
250 IF ?B% = 13 THEN A% = B% : GOTO 170
260 REM No line at expected position so
270 REM search for the start of a line
280 PRINT "No line"
290 B% = A% + 4
300 REPEAT B% = B% + 1
310    UNTIL (B% - A% = 255) OR (?B% = 13)
320 REM Line found so update previous
330 REM line length to bridge gap
340 IF ?B% = 13 THEN A%?3 = B% - A% : GOTO 170
350 REM No line found within maximum
360 REM permitted line length so there
370 REM is no alternative but to insert
380 REM an end of program marker
390 A%?1 = 255
400 REM Reset PAGE to LIST/SAVE the
410 REM recovered program
420 PAGE = EVAL(A$)
```

Listing 2. RECOVER routine by Jamie Stephenson

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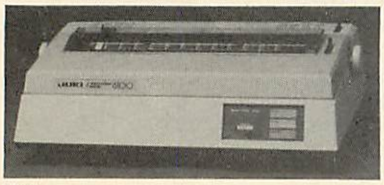
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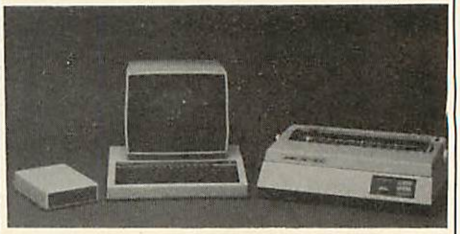
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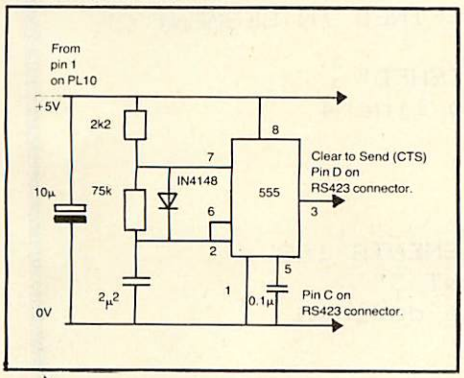
£5 TELETYPING by David Stonebanks

A TELETYPE should print correctly with carriage return followed by line feed. The carriage return movement will be completed before the next printing character is received unless the Teletype is faulty.

I have been using Teletype with my BBC micro for over a year without difficulty using the circuit in the diagram below.

This produces an output pulse of about 4 milliseconds at 9Hz, allowing the Beeb to send characters at this rate. I found that this pulse had to be less than half a bit time, otherwise the Beeb issued two characters. Modify baud rate as Beebug fix – change over link S28, select serial printer *FX5,2, transmit data rate 75 baud *FX8,1 (=110 baud with fix), width 60.

I have since read in *Acorn User*, September 1983 (page 57) that *FX156,16,227 should provide two stop bits so that my circuit (and the software in your present article) should not be necessary, but I haven't tried this.



SAVING TEXT FOR VIEW by Susan Jones £5

SCHOOLS and other educational establishments may have several BBC machines but only one copy of View. Listing 3 allows any BBC machine to create a text file which can later be read by View for editing, formatting and printing. The program works for both tape and disc and makes use of the maximum available memory.

Lines are entered one at a time, the return key being pressed after each one. The delete and copy keys can be used for the current line, but text already entered cannot be changed except by View.

The version of the program given here uses mode 3 so that 80 characters can be shown across the screen, but the mode statement may be changed to make more memory available. Input lines cannot be longer than 255 characters and the program will end text input automatically when there are fewer than 255 bytes of free memory left. To end text input normally, press return immediately after the '?' symbol (blank lines must contain at least one space).

The program will report how many lines in the text, then request the name of a file in which the whole text is to be saved. The default filename is TEXT.

To read this file in View, just go into command mode and type LOAD "filename" in the usual way.

```
 10 REM Program to create VIEW-compatible files
 20 MODE3:N%=HIMEM-LOMEM-24:*FX11,0
 30 DIM B% N%:P%=B%:L%=0:@%=5:C%=&C00
 40 PRINT'"Enter your text line by line"'
 50 REPEAT:V%=VPOS:L%=L%+1
 60 PRINT TAB(0,0);N%;" bytes remaining";SPC59
 70 PRINT TAB(0,V%);:INPUT LINE $P%
 80 N%=N%-LEN($P%)+1:P%=P%+LEN($P%)+1
 90 UNTIL P%?(-2)=&D OR N%<255
100 PRINT L%;" Lines of text entered"'
110 PRINT "Name of text file to be written";
120 INPUT $C%:IF $C%="" THEN $C%="TEXT" ELSE $C%=LEFT$($C%,6)
130 $C%="SAVE "+$C%+" "+STR$~B%+" "+STR$~P%
140 PRINT '$C%':X%=0:Y%=&C:CALL &FFF7
150 MODE7:*FX12,0
160 END
```

Listing 3. Creates a View-readable text file.

£5 HIDDEN PROGRAMS by James Tyler

I THOUGHT you might be interested in the following techniques that I have come up with regarding the security of programs stored on disc. Both involve inserting 'invisible' control characters into the filename when saving programs on disc.

The first technique utilises the DELETE code CHR$127. If you have a program stored in the Beeb which you wish to save, here's an example of what you would do. Enter:

SAVE "PRO"+CHR$127+"G"

If you now enter *CAT, the program will appear to have been stored on the disc under the filename "PRG". This is, of course, due to the fact that the letter 'O' has been deleted from the display by CHR$127.

The progam may now only be loaded using:

LOAD "PRO"+CHR$127+"G"

Attempts to use any other filename will result in a 'file not found' message.

Several DELETE codes could be inserted in different parts of a filename to increase the program's security.

The other technique is similar and involves putting teletext colour codes at the end of a filename, for example:

SAVE "NAME"+CHR$129

As before, the control code (red in this case) will not be displayed when the disc is *CATalogued but it is still required when the program is to be loaded:

LOAD "NAME"+CHR$129

Also, since colour control codes may be obtained directly by pressing function keys, it may be more convenient to load the last program using

LOAD "NAME[f2]"

By adding different combinations of colour codes onto the end of filenames, the security of programs may again be increased.

BASIC BUG £5 by R B Pinsker

I HAVE discovered a bug in the BBC Basic assembler, present in both versions of the language. For example:

ROL ADDR is interpreted as ROL A
LSR AP2 is interpreted as LSR A

and, in fact, if any symbol beginning with 'A' is placed after ASL, LSR, ROL or ROR it will be interpreted as accumulator addressing mode.

This can be overcome by placing the symbol in brackets:

ROL (ADDR)

The assembler does not attempt to interpret this as some form of *indirect* addressing.

I THINK this might be described as a peculiarity of the assembler rather than a bug, but thanks for pointing it out – Ed

£5 VERIFY A FILE

by Richard Bhanap

IN RESPONSE to your recent request in *Acorn User* for a verifier program, I offer this VERIFY key definition (listing 4) guaranteed to verify a cassette/disc file on a Beeb model A/B with OS 0.1/1.2 and Basic I/II – ie, on any Beeb.

It can verify a file of any length on backing store with one in memory and only takes as long as it takes to save the same program. I find it particularly useful when using the cassette filing system, since this is more prone to mishap than disc.

I hope readers will find my VERIFY as useful as I have. To use it, simply press f0.

```
   10 *KEY0 CLS:INPUT'
"Filename";F$:PRINT'"S
earching":Z=OPENIN(F$)
:FOR J%=PAGE TO TOP-1:
A%=BGET#Z:IF ?J%<>A% T
HEN PRINT '"ERROR":CLO
SE #Z:STOP:ELSE NEXT J
%:PRINT'"OK":CLOSE#Z|M
```

Listing 4. VERIFY key definition

£5 SPACE PROBLEM

by J T Hindle

HANDLING two-dimensional arrays does not sound too difficult (if you know the maths). I was dealing with two integer arrays X and Y which pointed to the third value Z, to which the obvious solution was to use an array Z(X,Y). However, the values of X and Y ranged from 1 to 47 so that a 2129 element array would be needed, occupying nearly 9000 bytes of memory. Since Z ranged from 1 to 71 there had to be a better way!

The solution was to turn X and Y into ASCII codes from A to o by adding 64. The corresponding characters can then be put into a string in the appropriate combinations and sequence and located using INSTR. For example:

Z	X	Y	X#	Y#
1	1	1	A	A
2	2	7	B	G
3	12	8	L	H

The string Z# is then "**AA*BG*LH*" The asterisks are to correct the start of the string and to separate data pairs so that the first two pairs in the example cannot be interpreted as AB.

The value of Z can now be obtained from (INSTR(Z#,K#))/3 where K# is X# + Y# + "*". For the original problem Z# occupies only 239 bytes – a useful saving! If necessary, more than one string may be used for Z# and of course more than two initial variables may be used.

SEQUENTIAL TAPES by P H Cowley £5

I WAS interested to read the article in November's *Acorn User* about disc file overlays. I must point out that the technique can be equally useful for tape users. Listings 5, 6 and 7 demonstrate how a number of programs may be run in sequence.

I have used the technique when carrying out number-crunching on large arrays. Once the crude number bashing is complete the next segment of program is automatically loaded to plot the results using the data which is still in memory. An advantage of this method is that each segment needs only minimal alteration from a stand-alone program, allowing *debugging* to proceed on each segment individually.

Listing 5. Enter without spaces or extra lines unless the load address is to be changed.

```
 1 REM SEGMENT 1
 2LOMEM=HIMEM-&1000
 4REPEAT
 6*LOAD""0E21
```

Program 6.

```
 10 REM SEGMENT 2
 20 Will not run without SEGMENT 1
 30 PRINT '"RUNNING SEGMENT 2"
 40 X=2
 50 Y=3
 60 Z=12.97
 70 A$="X,Y AND Z WERE DEFINED IN SEGMENT 2"
 80 integer%=1234
 90 PRINT "SEGMENT 2 FINISHED"
100 REM Return control to line 4
110 REM of SEGMENT 1
120 UNTIL FALSE
```

Program 7.

```
 10 REM SEGMENT 3
 20 Will only run with SEGMENTS 1&2
 30 PRINT '"RUNNING SEGMENT 3"
 40 REM A$,X,Y, and Z were defined
 50 REM in SEGMENT 2
 60 PRINT A$
 70 PRINT "X=";X
 80 PRINT "Y=";Y
 90 A=(X+Y)/Z
100 PRINT "(X+Y)/Z=";A
110 PRINT "Integer=";integer%-233
120 PRINT "END OF SEGMENT 3"
130 REM Leave REPEAT loop started
140 REM at line 4 of SEGMENT 1
150 UNTIL TRUE
160 END
```

PROCEDURE I D by B Cope £5

WHEN developing a structured program, do you have difficulty in locating a procedure so that you can improve it? Do you have even more difficulty after you have renumbered the program?

A neat solution is to identify the procedures and their line-numbers at the start of your program:

```
10 GOTO 200
20 PROCinit:GOTO 600
30 PROCintro: GOTO 900
40 PROCoption:GOTO 1510
etc
200 REM The program starts
etc
600 DEF PROCinit
etc
```

The purpose of the GOTO in line 10 is to avoid executing the following few lines. The other GOTOs are to ensure that the procedure line-numbers are automatically updated during any future renumbering.

SELECT COPIER

Pick your files and copy them all to another disc in one operation – with this program by Robin Newman

ONE of the shortcomings of the Acorn disc filing system is that although there is a selective delete command *DESTROY there is no comprehensive selective copy command. You can use *COPY with the wildcard characters '#' and '*', but in general this restricts you to copying all the files in a given directory or all the files which start with, say, the same letter. If you wish to copy a random selection of the files from one disc to another it is generally only possible to do this one file at a time using *COPY.

This utility enables you to select *any* combination of files from a disc catalogue and copy the combination in one operation. It will work with either a single or a dual drive, although in the former case you will of course, have to change over the source and destination discs when prompted.

In this version I have deliberately avoided using the EQU commands available with Basic II, although it makes the program slightly messier to read, so that those with Basic I can use it. Also, colour commands have been included explicitly for clarity – eg CHR$130 – but you can simplify matters by using the shifted function key codes given on page 154 of the *User Guide* and incorporate them in the relevant print statements.

The program incorporates a machine code sort procedure for a string array taken from Ian Birnbaum's book *Assembly Language Programming for the BBC Microcomputer*. Publication therefore should be only with his consent and with due acknowledgement. However, the program will still work if the sort procedure (lines 6000-7190) is removed, together with lines 190 & 200, although the catalogue will not then be displayed in alphabetical order while the selection is being made.

The program falls into five parts:

1. The source and destination drives are selected (lines 10-110).
2. The source catalogue is read into a buffer (PROCassemble_read_cat and then the filenames are decoded into a string array (PROCdecode_cat).
3. The filenames are sorted into alphabetical order (PROCassemble_sort_code and line 200) and then displayed on the screen (PROCdisplay_cat).
4. The files to be copied are marked and a record kept in array C (PROCmark_cat) and then a list of the filenames to be copied is assembled at &1200 (PROCsetup_copy).
5. Finally, a short piece of machine code is assembled at &1400 (by PROCassemble_mccopy) which will pass the required copy commands one by one to the command line interpreter: ie, the actual copying is done using the standard disc *COPY command. This code is called in a rather odd manner. The command CALL&1400 is inserted in the keyboard buffer and then the program ends, whereupon the code is called. This is so that the code is called from immediate mode, because by the time the copying has finished the "SELCOPY" program will have been overwritten and it will not be possible for control to be returned to it. This somewhat messy transfer of control is masked by switching the screen off while the command CALL&1400 is processed (using VDU21) and switching it on again within the machine code (effectively using VDU6).

It is important that you save the program *before* trying it out as it is destroyed in the copying process.

In the listing, the '£' sign is the hash key (shifted 3) and the '[' (open square bracket) key is printed as a left-pointing arrow in mode 7, in which the program is run. ●

```
   10 REM SELCOPY
   20 REM Selective Copier (c) R.Newman
   30 REM Oundle School Aug.1983 VER 1.4
   40 REM Basic I version
   50 MODE7:PRINTTAB(5,2)CHR$129"S e l e c t i v e  C o p i e r"'
   60 PRINTCHR$130"Source drive (0-3) ";
   70 SD%=GET-48:IF SD%<0 OR SD%>3 THEN 70 ELSE PRINTSTR$(SD%)'
   80 PRINTCHR$130"Destination drive (0-3) ";
   90 DD%=GET-48:IF DD%<0 OR DD%>3 THEN 90 ELSE PRINTSTR$(DD%)'
  100 PRINTCHR$130"Is this OK? (Y/N) ";
  110 A$=GET$:IF A$="N" THEN RUN ELSE IF A$<>"Y" THEN 110
  120 PRINTA$''
  130IF SD%=DD% PRINT"Insert source disk in drive ";SD%'"& push"CHR$131"RETURN
";:ELSE PRINT"Insert source and destination disks"'"& push"CHR$131"RETURN ";
  140 REPEAT UNTIL GET=13:PRINT
  150 PROCassemble_read_cat
  160 CALLreadcat
  170 IF blk?10<>0 THEN VDU7:CLS:PTAB(5,5)"Disk Read Error":STOP
  180 PROCdecode_cat
  190 PROCassemble_sort_code
  200 CALLsort,E%,NAME$(0)
  210 PROCdisplay_cat
  220 PROCmark_cat
  230 PROCsetup_copy
  240 PROCassemble_mccopy
  250 IF N%=0 THEN PRINTTAB(5,2)CHR$129"No Files Selected for Copying":END
  260 PRINTTAB(5,2)CHR$129"Commencing Copying..."
  270 REM insert CALL&1400 in keybd buffer
  280 REM and exit program
```

continued on page 63 ▶

```
290 *FX15
300 *FX138,0,67
310 *FX138,0,65
320 *FX138,0,76
330 *FX138,0,76
340 *FX138,0,38
350 *FX138,0,49
360 *FX138,0,52
370 *FX138,0,48
380 *FX138,0,48
390 *FX138,0,13
400 VDU21:REM switch off screen to avoid untidy call command
410 END
1000 DEFPROCassemble_read_cat
1010 DIM BUF% &200,readcat &50,sort &D0
1020 osword=&FFF1
1030 FOR Z%=0 TO 3 STEP 2
1040 P%=readcat
1050 [OPTZ%
1060 LDA £&7F:LDX£ blk MOD 256:LDY £blk DIV 256
1070 JMP osword
1080 .blk:]
1090 REM parameter block for read command
1100 ?P%=SD%:P%!1=BUF%:P%?5=3:P%?6=&53:P%?7=0:P%?8=0:P%?9=&22:P%?10=0
1110 NEXT
1120 ENDPROC
2000 DEFPROCdecode_cat
2010 E%=(BUF%?&105)/8:REM number of cat.entries
2020 DIM NAME$(E%-1),C(E%-1)
2030 FOR Z%=0 TO E%-1
2040 FORY%=0 TO 6
2050 NAME$(Z%)=NAME$(Z%)+CHR$(BUF%?(Y%+8*(Z%+1)))
2060 NEXT
2070 REM Find Directory: allow for files in DIR 0
2080 REM used by the Author for certain protected files!
2090 D%=BUF%?(Y%+8*(Z%+1)):IF D%=0 THEN D%=32 ELSE IF D%=&80 THEN D%=&80+32
2100 REM work out Locked entries
2110 IF D%<128 THEN NAME$(Z%)=CHR$(D%)+"."+NAME$(Z%):ELSE D%=D%
AND&7F:NAME$(Z%)=CHR$(D%)+"."+NAME$(Z%)+" L"
2120 NEXT
2130 ENDPROC
3000 DEFPROCdisplay_cat
3010 CLS:PRINTTAB(5,1)CHR$129"F i l e  S e l e c t i o n"
3020 PRINTTAB(0,4);
3030 FORZ%=0TO E%-1STEP2
3040 PRINTTAB(1)NAME$(Z%)TAB(12)CHR$131" "CHR$135;:IF Z%<=E%-2 THEN
PRINTTAB(20);NAME$(Z%+1)TAB(31)CHR$131" "CHR$135
3050 NEXT
3060 PRINT
3070 ENDPROC
4000 DEFPROCmark_cat
4010 REM Cursor Off
4020 VDU23,1,0;0;0;0;
4030 PRINTTAB(0,21)CHR$130"Select file with"CHR$131"["CHR$130"using cursor
keys"'CHR$131"SPACEBAR"CHR$130"marks file for
copying"'CHR$130"Use"CHR$131"DELETE"CHR$130"for
corrections"'CHR$131"@"CHR$130"ends selection and initiates copying";
4040 REM enable cursor key codes
4050 *FX4,1
4060 REM adjust key repeat & delay rates
4070 *FX12,20
4080 *FX11,20
4090 X=13:Y=4
4100 PRINTTAB(X,Y)"["
4110 REM mark entries to be copied
```

continued on page 65 ▶

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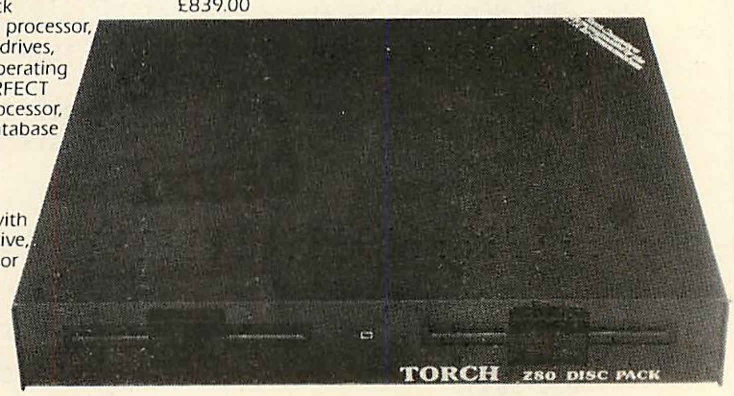
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```
 4120 REPEAT
 4130 Z=GET
 4140 REM test for cursor keys and move if possible
 4150 REM The complicated conditions ensure
 4160 REM the [ can only be moved beside a file entry
 4170 REM Cursor Down
 4180 IF Z=138 AND NOT ((Y=3+(E%+1)DIV2-1)AND(X=32)AND(E%MOD2=1))AND
NOT(Y>2+(E%+1)DIV2) THEN PRINTTAB(X,Y)" ":Y=Y+1:PRINTTAB(X,Y)"["
 4190 REM Cursor Up
 4200 IF Z=139 AND Y>4 THEN PRINTTAB(X,Y)" ":Y=Y-1:PRINTTAB(X,Y)"["
 4210 REM Cursor Right
 4220 IF Z=137 AND NOT((Y=3+(E%+1)DIV2)AND E%MOD2=1)THEN PRINTTAB(X,Y)"
":X=32:PRINTTAB(X,Y)"["
 4230 REM Cursor Left
 4240 IF Z=136 THEN PRINTTAB(X,Y)" ":X=13:PRINTTAB(X,Y)"["
 4250 REM test for Spacebar and mark file in array C
 4260 IF Z=32 THEN PRINTTAB(X-13,Y)CHR$130:C(2*(Y-4)+1+(X=13))=1
 4270 REM test for Delete and remove file marker from array C
 4280 IF Z=127 THEN PRINTTAB(X-13,Y)" ":C(2*(Y-4)+1+(X=13))=0
 4290 REM exit on @ being pushed
 4300 UNTIL Z=64
 4310 REM restore repeat & delay rates
 4320 *FX12
 4330 PRINT
 4340 REM restore cursor operation
 4350 *FX4
 4360 REM Cursor On
 4370 VDU23,1,1;0;0;0;
 4380 ENDPROC
 5000 DEFPROCsetup_copy
 5010 REM Set up file names to be copied
 5020 REM in a list starting at &1200
 5030 CLS
 5040 K%=&1200:N%=0
 5050 FORZ%=0 TO E%-1
 5060 IF C(Z%)=0 THEN 5090
 5070 $K%=LEFT$(NAME$(Z%),9)
 5080 K%=K%+10:N%=N%+1
 5090 NEXT
 5100 ENDPROC
 6000 DEFPROCassemble_sort_code
 6010 REM this proc is written by Ian Birnbaum
 6020 REM and is published in his book
 6030 REM Assembly Language Programming
 6040 REM for the BBC Microcomputer
 6050 REM modified to ignore lower case
 6060
LOOPCOUNTH=&70:FIRST=&71:SECOND=&73:TEMP=&75:
ADDRESS=&76:NUMBER=&78:STORE1=&7A:S
TORE2=&7C:LGTH1=&7E:LGTH2=&7F:OSWRCH=&FFEE
 6070 FORI%=0TO2STEP2:P%=sort
 6080 [OPTI%
 6090 LDA&600
 6100 CMP£2
 6110 BNE MISTAKE
 6120 LDA&603
 6130 CMP£4
 6140 BNE MISTAKE
 6150 LDA&606
 6160 CMP£&81
 6170 BEQ OK
 6180 .MISTAKE
 6190 LDA£ASC("?")
 6200 JSR OSWRCH
 6210 RTS
 6220 .OK
 6230 LDA&601
 6240 STA FIRST
 6250 LDA&602
 6260 STA FIRST+1
 6270 LDY£0
 6280 LDA(FIRST),Y
 6290 SEC
 6300 SBC£1
 6310 STA NUMBER
 6320 INY
 6330 LDA(FIRST),Y
 6340 SBC£0
 6350 STA NUMBER+1
 6360 .LOOP3
 6370 LDA&604
 6380 STA STORE2
 6390 LDA&605
 6400 STA STORE2+1
 6410 LDX£0
 6420 STX LOOPCOUNTH
 6430 .LOOP4
 6440 LDY£0
 6450 LDA STORE2+1
 6460 STA STORE1+1
 6470 LDA STORE2
 6480 STA STORE1
 6490 CLC
 6500 ADC£4
 6510 STA STORE2
 6520 BCC NOCARRY3
 6530 INC STORE2+1
 6540 .NOCARRY3
 6550 LDA(STORE1),Y
 6560 STA FIRST
 6570 LDA(STORE2),Y
 6580 STA SECOND
 6590 INY
 6600 LDA(STORE1).Y
```

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```
6610 STA FIRST+1
6620 LDA(STORE2),Y
6630 STA SECOND+1
6640 LDY£3
6650 LDA(STORE1),Y
6660 STA LGTH1
6670 LDA(STORE2),Y
6680 STA LGTH2
6690 LDY£0
6700 .LOOP5 \check for lower case and ignore
6710 LDA(SECOND),Y:CMP£97:BCC normal:SEC:SBC£32:.normal STA TEMP
6720 LDA(FIRST),Y:CMP£97:BCC normal2:SEC:SBC£32
6730 .normal2 CMP TEMP
6740 BCC NEWRECORD
6750 BNE SWAP
6760 INY
6770 CPY LGTH1
6780 BEQ NEWRECORD
6790 CPY LGTH2
6800 BEQ SWAP
6810 BNE LOOP5
6820 .PIVOT1
6830 BPL LOOP3
6840 .PIVOT2
6850 BNE LOOP3
6860 .SWAP
6870 LDY£3
6880 .LOOP6
6890 LDA(STORE1),Y
6900 STA TEMP
6910 LDA(STORE2),Y
6920 STA(STORE1),Y
6930 LDA TEMP
6940 STA(STORE2),Y
6950 DEY
6960 BPL LOOP6
6970 .NEWRECORD
6980 INX
6990 BNE NTZERO
7000 INC LOOPCOUNTH
7010 .NTZERO
7020 CPX NUMBER
7030 BNE LOOP4
7040 LDA LOOPCOUNTH
7050 CMP NUMBER+1
7060 BNE LOOP4
7070 DEC NUMBER
7080 BEQ LOWZERO
7090 LDA NUMBER
7100 CMP£&FF
7110 BNE PIVOT2
7120 DEC NUMBER+1
7130 BPL PIVOT1
7140 .LOWZERO
7150 LDA NUMBER+1
7160 BNE PIVOT2
7170 RTS
7180 ]NEXTI%
7190 ENDPROC
8000 DEFPROCassemble_mccopy
8010 oscli=&FFF7
8020 FORZ%=0TO3STEP2
8030 REM This code uses buffer space allocated to the DFS.
8040 REM It should not normally be in use when this
program is used.
8050 P%=&1400:copylist=&70:numfiles=&72
8060 [OPT Z%
8070 LDA£6:JSR&FFEE \switch on screen
8080 LDA £N%:BNE ok:RTS \double check there are
files to copy!
8090 .ok STA numfiles:LDA £0:STA copylist:LDA £&12:
STA copylist+1 \copylist stored at &1200
8100 LDA £SD%+&30:STA dinfo:LDA £DD%+&30:STA dinfo+1
\store drive numbers in copy string
8110 .nxfile LDY £9
8120 .nxfile2 LDA (copylist),Y:STA buf,Y:DEY:BPL nxfile2
\move next filename to copy string
8130 LDX £osc MOD256:LDY £osc DIV256:JSR oscli \send to
Command Line Interpreter
8140 LDA £10:CLC:ADC copylist:STA copylist:LDA £0:ADC
copylist+1:STA copylist+1
\move pointers in copylist
8150 DEC numfiles:BNE nxfile \check if more files
8160 RTS \finished!
8170 .osc:]
8180 REM copy string follows. Drives inserted in dinfo
and dinfo+1
8190 REM filename in buffer 'buf'
8200 $P%="COPY":P%=P%+4:dinfo=P%:?P%=0:P%?1=0:P%?2=32
8210 P%=P%+3:buf=P%
8220 NEXT
8230 ENDPROC
```

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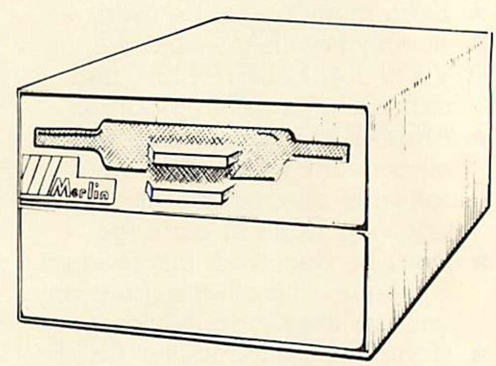
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ANYBODY who has used the function keys on the Beeb or Electron knows what a blessing they are. Efficient use of them means that Basic text can be entered in a fraction of the time that would otherwise be needed. Trouble is, though, that editing them means typing in the whole definition again. Here's a routine (program 1) that will take care of just that. The final version (program 2), written in machine code, can sit in a quiet corner of the memory map and be called whenever a listing of key definitions is required. Figure 1 shows the output produced by the program. Editing a key definition can be done in the normal manner, using the cursor control and copy keys.

To understand how the program works requires a little knowledge about how the key definitions are handled and stored in memory.

The soft key buffer is located between &B00 and &BFF. However, the first 17 bytes of this, &B00 to &B10, are allocated to the function keys, each byte relating to a particular function key (see figure 2) rather than directly to the definition contained within the key. This means that the space available for key definitions is reduced to 239 bytes.

To investigate this area of memory further it is useful to produce a hexadecimal and ASCII dump of the region. Program 1 provides such a dump. Before entering it switch your Beeb off at the back to ensure that the operating system resets the entire region. Running the dump program at this stage should produce the result shown in figure 3, the entire soft key buffer being filled with &10. Now enter a key definition such as:

*KEY0 PRINT "HELLO THERE"¦M

Re-running the dump program shows the definition within the buffer (figure 4). The dump clearly shows that the 'PRINT "HELLO THERE"' portion of the definition is within the buffer. Note that the 'M' has been replaced by &0D (ASCII RETURN). The key associate bytes now give some indication as to their operation. The first byte we know is associated with key 0. This byte contains &10 (16 in decimal). If we count 16 bytes from this location we arrive at the last byte of the key associate bytes (&B10), which is immediately followed by the key definition; therefore the address of the KEY0 definition is simply:

&B00+(?&B00+1)

The values in the rest of the key-associated bytes have changed from &10 to &23 (or 35 decimal). Counting 35 from &B00 brings us to the last byte of the definition: the carriage return character &0D at &B23. From this it would seem that the address of the last byte in the definition can be ascertained by PRINT −&B00+(&B00?1). However, further thought shows that this cannot be true, for if we were to define key 1 we would overwrite this byte. In fact, as you may have noticed from figure 2, the last of the reserved bytes at &B10 has no key associated with it but instead points to the top of the keyboard buffer definitions at any one time. By peeking this value it is possible to calculate the amount of space remaining in the buffer.

Figure 5 shows the effect on memory if a further definition is added, such as:

*KEY7 CLS:VDU7 ¦M

This definition is entered on to the buffer directly above the previous one. The key 7 associate byte at &B07 still contains &23, but the undefined key bytes and the pointer byte have been updated to point to the last byte after the newly entered definition.

The reasons for updating the undefined key bytes are twofold. First, by comparing a key byte with the pointer byte, the MOS can immediately tell whether or not a key is defined, thus making the redefinition of keys much easier. Second, it makes entering new key strings simpler, as an index from &B00 is immediately available, allowing the relative bytes to be stored directly into memory.

What happens if a key is redefined? Figure 6 shows the reshuffled buffer after executing:

*KEY0OLD ¦M

Here we see that the still-valid definition of

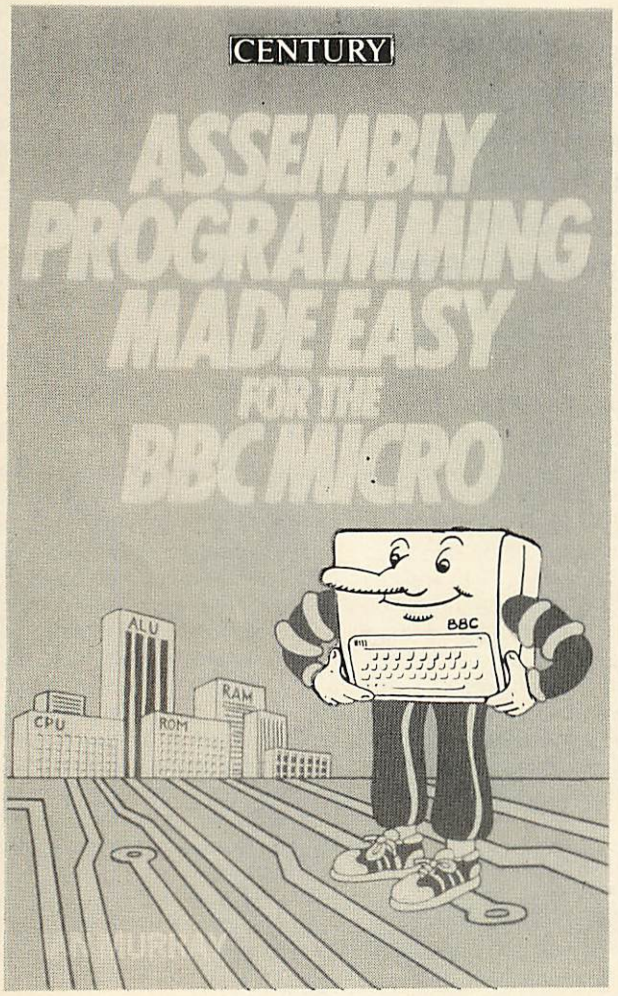
```
*KEY  0 CALL&C00¦M
*KEY  1 RUN ¦M
*KEY  2 PRINT CHR$(12) ¦M
*KEY  3
*KEY  4 SAVE"TEMP" ¦M
*KEY  5
*KEY  6 LOAD"TEMP" ¦M
*KEY  7
*KEY  8
*KEY  9 LIST ¦M
*KEY 10 OLD ¦M
*KEY 11
*KEY 12
*KEY 13
*KEY 14
*KEY 15
```

Figure 1. Typical output of main program

Soft Key Buffer		Key Associated Bytes	
&B00	:	Key 0	
&B01	:	Key 1	
&B02	:	Key 2	
&B03	:	Key 3	
&B04	:	Key 4	
&B05	:	Key 5	
&B06	:	Key 6	
&B07	:	Key 7	
&B08	:	Key 8	
&B09	:	Key 9	
&B0A	:	Key 10	<BREAK> key
&B0B	:	Key 11	<COPY> key
&B0C	:	Key 12	← cursor left key
&B0D	:	Key 13	→ cursor right key
&B0E	:	Key 14	↓ cursor down key
&B0F	:	Key 15	↑ cursor up key
&B10	:	Key definition 'TOP' pointer	

Figure 2. Key-associated bytes of the soft key buffer

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```
B00 10 10 10 10 10 10 10 10 ........
B08 10 10 10 10 10 10 10 10 ........
B10 10 10 10 10 10 10 10 10 ........
B18 10 10 10 10 10 10 10 10 ........
B20 10 10 10 10 10 10 10 10 ........
B28 10 10 10 10 10 10 10 10 ........
B30 10 10 10 10 10 10 10 10 ........
B38 10 10 10 10 10 10 10 10 ........
B40 10 10 10 10 10 10 10 10 ........
B48 10 10 10 10 10 10 10 10 ........
B50 10 10 10 10 10 10 10 10 ........
B58 10 10 10 10 10 10 10 10 ........
B60 10 10 10 10 10 10 10 10 ........
```

Figure 3. Soft key buffer reset to contain &10 throughout

```
B00 10 23 23 23 23 23 23 23 .#######
B08 23 23 23 23 23 23 23 23 ########
B10 23 50 52 49 4E 54 22 48 #PRINT"H
B18 45 4C 4C 4F 20 54 48 45 ELLO THE
B20 52 45 22 0D 10 10 10 10 RE".....
B28 10 10 10 10 10 10 10 10 ........
B30 10 10 10 10 10 10 10 10 ........
B38 10 10 10 10 10 10 10 10 ........
B40 10 10 10 10 10 10 10 10 ........
B48 10 10 10 10 10 10 10 10 ........
B50 10 10 10 10 10 10 10 10 ........
B58 10 10 10 10 10 10 10 10 ........
B60 10 10 10 10 10 10 10 10 ........
```

Figure 4. The buffer after the entry of *KEY0 PRINT "HELLO THERE" ¦M

```
B00 10 20 20 20 20 20 20 23 .......#
B08 20 20 20 20 20 20 20 20 ........
B10 20 50 52 49 4E 54 22 48 .PRINT"H
B18 45 4C 4C 4F 20 54 48 45 ELLO THE
B20 52 45 22 0D 43 4C 53 3A RE".CLS:
B28 56 44 55 37 0D 10 10 10 VDU7....
B30 10 10 10 10 10 10 10 10 ........
B38 10 10 10 10 10 10 10 10 ........
B40 10 10 10 10 10 10 10 10 ........
B48 10 10 10 10 10 10 10 10 ........
B50 10 10 10 10 10 10 10 10 ........
B58 10 10 10 10 10 10 10 10 ........
B60 10 10 10 10 10 10 10 10 ........
```

Figure 5. The buffer after *KEY7 CLS:VDU7 ¦M

key 7 has been moved up to the start of the buffer and the new key 0 definition placed after it. The key-associated bytes and pointer have been adjusted accordingly.

Using the above information, the task of writing a program to print the KEY contents is greatly simplified. Program 2 lists the assembler. The source listing generates 126 bytes of hex code, which makes it small enough to be tucked neatly away. I have chosen to use the user defined character buffer located at &C00. As always, changing the value assigned to P% in line 100 makes the code relocatable.

Figure 6 flowcharts the program's operation, which can be clearly seen as two loops imbedded one inside the other. The program begins by printing out the word "*KEY", followed by the key number. The former is handled by 'print_word_key' subroutine held in lines 480 to 550. The ASCII characters have been entered using the pseudo-mnemonic EQUS. Basic I owners can achieve the same result using the clever routines provided by Jonathan Griffiths in the January issue of *Acorn User*. Note that the key string is back-to-front and includes two spaces before the 'Y' and a single space after the '*'. The key number printing routine uses a look-up table to obtain the ASCII characters to be printed.

Throughout the program the X register is used to hold the number of the key currently being processed. As keys 10 to 15 need two ASCII characters, numbers 0 to 9 are preceded with a space to pad them out. This also aids in justifying the key numbers when they are printed (see figure 1). As each key number consists of two characters, the X register needs to be multiplied by two to obtain the correct index into the table. Line 140 takes care of this, transferring the register's contents into the accumulator before executing an arithmetic shift left. The new value is then returned to the index register. On completion of the number printing, the original value of the X register is restored by dividing it by two with a logical shift right.

The current key-associated byte is loaded into the accumulator and compared to that held in the key top pointer (lines 230, 240). If they are dissimilar a key definition exists and therefore the branch over executed. Otherwise the program is updated and the next key definition searched out.

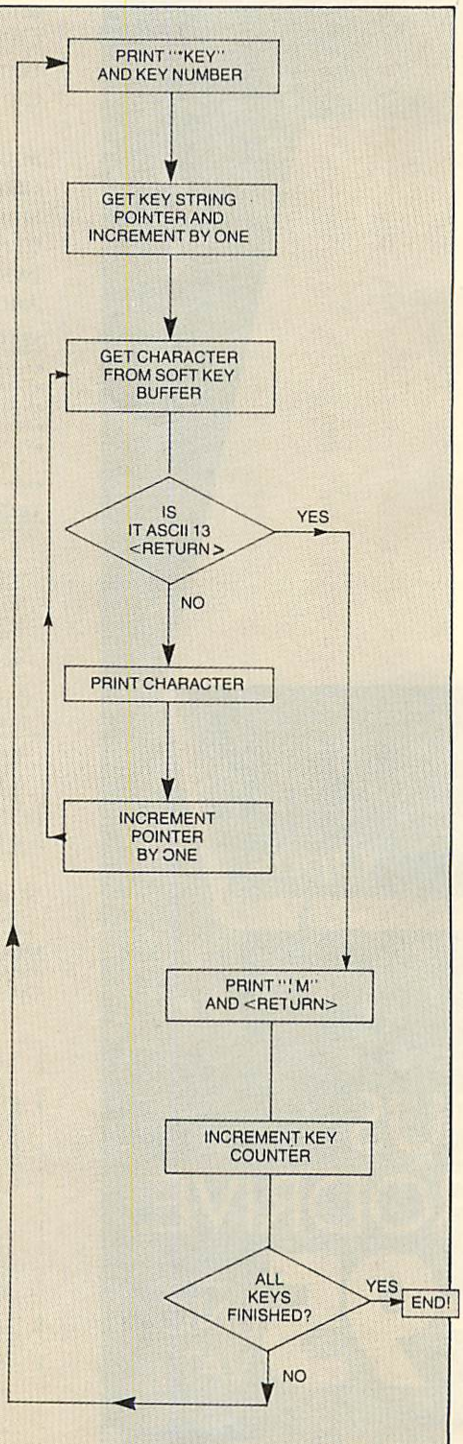


Figure 6. Program flow chart

```
RUN
  B00 10 10 10 10 10 10 10 10 ........
  B08 10 10 10 10 10 10 10 10 ........
  B10 10 43 4C 53 3A 56 44 55 .CLS:VDU
  B18 37 0D 4F 4C 44 0D 48 45 7.OLD.HE
  B20 52 45 22 0D 43 4C 53 3A RE".CLS:
  B28 56 44 55 37 0D 10 10 10 VDU7....
  B30 10 10 10 10 10 10 10 10 ........
  B38 10 10 10 10 10 10 10 10 ........
  B40 10 10 10 10 10 10 10 10 ........
  B48 10 10 10 10 10 10 10 10 ........
  B50 10 10 10 10 10 10 10 10 ........
  B58 10 10 10 10 10 10 10 10 ........
  B60 10 10 10 10 10 10 10 10 ........
  B68 10 10 10 10 10 10 10 10 ........
  B70 10 10 10 10 10 10 10 10 ........
  B78 10 10 10 10 10 10 10 10 ........
  B80 10 10 10 10 10 10 10 10 ........
  B88 10 10 10 10 10 10 10 10 ........
  B90 10 10 10 10 10 10 10 10 ........
  B98 10 10 10 10 10 10 10 10 ........
  BA0 10 10 10 10 10 10 10 10 ........
```

Figure 7. The buffer after redefining *KEY OLD ¦M

The character printing routine starts by moving the string byte offset from the accumulator into the Y register (line 280), where it is incremented ready for use. Using Y as an index the first string character is loaded into the accumulator and checked to see if it is a <RETURN> character (line 320), which would mark the end of the key string text. If the test is false the character is printed, the index register incremented and the next character accessed (line 360). When the Return character is located this inner loop is exited and the 'M' characters that are normally used to terminate a function key's definition are printed out (lines 380 to 410).

The update routine outputs a Return, then tests to see if all the keys have been serviced (lines 440 and 450). If not, the main loop is repeated.

There are several ways in which the program could be improved: you might like to undertake these suggestions as a project. First, the routine does not take into account key definitions that contain multiple Return characters. For example, definitions such as:

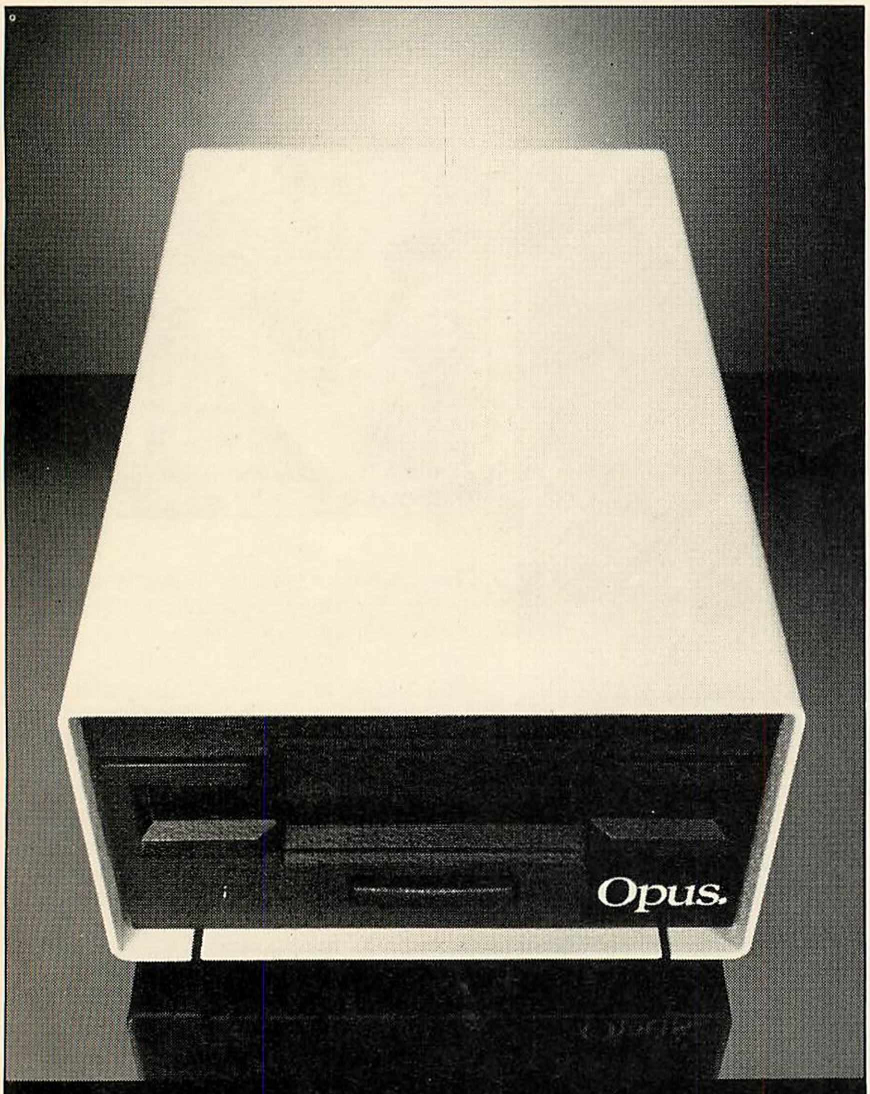
*KEY9 NEW ¦M LOAD "PROGRAM" ¦M LIST ¦M

are perfectly legal, but the program as it stands at present would print "*KEY 9 NEW M" only as it exits on the first Return character.

Second, the program uses the OSWRCH routine and control characters inserted into

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definitions would actually be printed as such. Therefore a key definition entered as

*KEY7 " |B LIST |M"

would produce a CTRL B when the printing code encounters it, turning the printer on and outputting the rest of the key listing to your printer. This is because the MOS interprets the 'B' as <CTRL> B when the string is entered and therefore places &02 into the appropriate position in the buffer.

Finally, it might be useful to extend the program to print the number of bytes remaining in the soft key buffer so that you know how much room is left.

For those still a little baffled by machine code, program 3 is a Basic listing which produces the same results as those already described and could be extended as described. It could be located away from the normal PAGE setting and called using those lovely function keys. ●

Program 1. Soft Key buffer hex/ASCII dump

```
 10 REM *** MEMORY DUMP ROUTINE ***
 20 @%=0
 30 CLS
 40 PRINT"SOFT KEY BUFFER"''
 50 start%=&B00
 60 FOR loop=0 TO 160 STEP 8
 70 PRINT ~(start%+loop);"  ";
 80 FOR byte=0 TO 7
 90 peek=?(start%+loop+byte)
100 byte?&70=peek
110 IF peek<&10 THEN PRINT "0";
120 PRINT ~peek;" ";
130 NEXT
140 FOR character=0 TO 7
150 ascii=character?&70
160 IF ascii<&20 PRINT "."; ELSE PRINT CHR$(ascii);
170 NEXT
180 PRINT
190 NEXT
```

Program 2. Source code listing

```
 10REM *** FUNCTION KEY DEFINITION PRINTER ***
 20REM *** (c) Bruce Smith         1984    ***
 30REM *** assembles into user defined     ***
 40REM *** character area. 126 bytes long  ***
 50key=&B00
 60pointer=&B10
 70oswrch=&FFEE
 80osasci=&FFE3
 90FOR pass=0 TO 3 STEP3
100P%=&C00
110[OPT pass
120LDX #0                  \ set key offset
130.main_loop
140TXA : ASL A :TAX        \ multiply offset by 2
150JSR print_word_key      \ print "*KEY"
160LDA number_table,X      \ get two digit
170JSR oswrch              \ key number from
180LDA number_table+1,X \ and print both
190JSR oswrch
200TXA : LSR A : TAX        \ divide offset by 2
210LDA #&20                 \ print a space
220JSR oswrch
230LDA key,X                \ get string pointer
240CMP pointer              \ is it=to top of buffer
250BNE over                 \ no, definition present
260JMP update               \ yes, no definition
270.over
280TAY                      \ move string pointer into Y
290INY                      \ and add one
300.next_character
310LDA key,Y                \ get character
320CMP #13                  \ is it a <RETURN> ?
330BEQ carraige_return      \ yes, process it
```

```
340JSR oswrch
350INY                       \ no, print character
360BNE next_character        \ move to next character
370.carraige_return          \ repeat again
380LDA #ASC"|"
390JSR oswrch                \ print "|M" to
400LDA #ASC"M"
410JSR oswrch                \ indicate end of string
420.update
430LDA#13:JSR osasci
440INX                       \ print a <RETURN>
450CPX#16                    \ increment offset
460BNEmain_loop              \ all 15 keys done?
470RTS                       \ no, so do all again
480.print_word_key           \ yes, back to good 'ole BASIC!
490LDY#6
500.next_letter              \ 5 characters to print
510LDA spell_key,Y
520JSR oswrch                \ get each letter
530DEY                       \ and print them
540BNE next_letter
550RTS                       \ until complete
560.number_table
570\ key number table
580 EQUS" 0 1 2 3 4 5 6 7 8 9101112131415"
590.spell_key
600EQUS "  YEK* "
610]
620NEXT
630END
```

Program 3. The Basic version

```
 10 key=&B00
 20 pointer=&B10
 30 FOR loop=0 TO 15
 40   PRINT "*KEY";loop;" ";
 50   IF loop<10 THEN PRINT" ";
 60   IF key?loop<>?pointer THEN PROC_print_key
 70   PRINT
 80   NEXT
 90 END
100 DEF PROC_print_key
110 string=(key+1+(key?loop))
120 counter=LEN($string)
130 FOR print_loop=0 TO counter
140   character=string?print_loop
150   IF character=13 THEN PRINT"|M"; ELSE PRINT CHR$(character);
160   NEXT
170 ENDPROC
```



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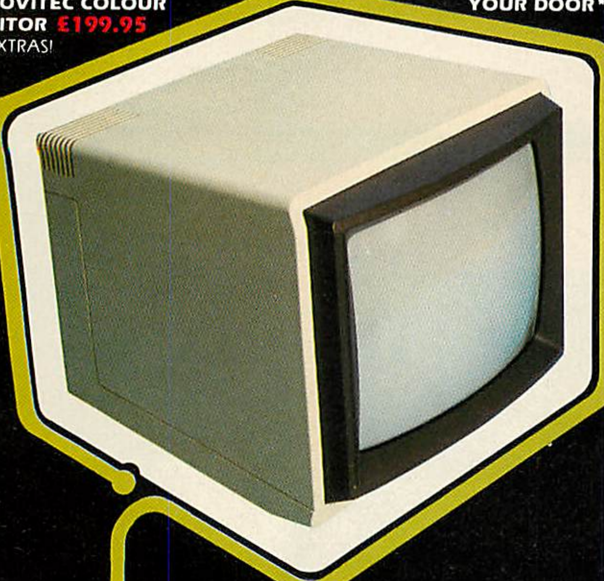
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TELETEXT BY ANOTHER MODE

While he's in the mode, George Hill devises a way of translating the teletext screen so that it can be dumped to *any* dot-matrix printer

LAST month I showed how the mode 7 and teletext screens could be dumped to the Epson and Star printers. At the end of that article I said that I did not have time to do the job for any printer. However, inspiration struck!

The inspiration was the thought that the Epson dump, using user-defined ('download') characters, could be mimicked within the Beeb. If user-defined characters could be set up in mode 4 to give a graphics capability similar to the mode 7 and teletext graphics, then it should be possible to 'translate' the teletext screen into mode 4. The mode 4 picture can now be dumped on any dot-matrix printer by conventional means.

The user-defined characters between 128 and 159 are defined as sets of 16 continuous and 16 broken graphics characters. This and other character redefinition is carried out using VDU23. I should point out problems for those with OS 0.1. They will have to be content with the graphics characters only, being unable to redefine the 'special characters' 91 to 95 and 123 to 126. They will also have to remove the *FX20 call, as this is not implemented in the older operating system, and use characters 224 to 255 (with base at 224), instead of 128 to 159.

I also need to bring your attention to inaccuracies in the *User Guide*. To use *FX20 to 'explode' the user-defined characters, you must ensure that space is left for the new character definitions in RAM. This requires not only space for your own characters, but space for copies of the ROM codes. The re-definition codes go into the buffer from &C00 to &CFF first. We need the whole of this buffer for the graphics characters. The explosion takes place in stages, using *FX20,n where n is between 0 and 6. Values of n above 1 are not mentioned in the ordinary *User Guide*. The *Advanced User Guide* has it roughly as in table 1.

OSHWM is most easily obtained by typing:

```
CTRL BREAK
PRINT~PAGE
```

This will yield a hexadecimal number that will be variously &0E00, &1100, &1900, &1B00 or even higher, depending what sideways ROMs you have fitted. Obviously we have to leave &600 bytes of memory clear if we want to define characters in all ranges. The program uses *FX20,6, and so must be loaded and run at an address &600 above the normal value of PAGE. This is taken care of in the loading program 1, but you must do it yourself if you use the program in any other way. In principle, before using program 2 (the translator), PAGE must be reset by the line:

```
PAGE=PAGE+&600
```

Program 2 reads the teletext screen character by character and builds a screen image in memory. This consists of a block of 1000 ASCII-type codes. Mode 4 is now selected and the codes are read line by line. The codes are adjusted as last month to produce a unified set. If the code represents a text character, then the corresponding mode 4 character is printed, with



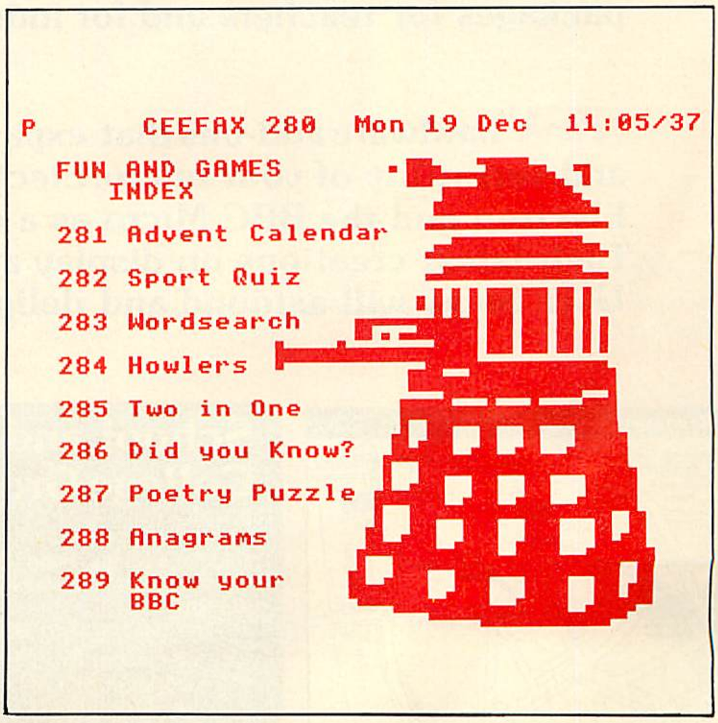


Table 1. The redefinition codes

OS call	Action	Codes	Memory used
*FX20,0	allows redefinition of	128 to 159	&C00 to &CFF
*FX20,1	effect of *FX20,0 and	160 to 191	OSHWM TO OSHWM+&FF
*FX20,2	effect of *FX20,1 and	192 to 223	OSHWM+&100 to OSHWM+&1FF
*FX20,3	effect of *FX20,2 and	224 to 255	OSHWM+&200 to OSHWM+&2FF
*FX20,4	effect of *FX20,3 and	32 to 63	OSHWM+&300 to OSHWM+&3FF
*FX20,5	effect of *FX20,4 and	64 to 95	OSHWM+&400 to OSHWM+&4FF
*FX20,6	effect of *FX20,5 and	98 to 127	OSHWM+&500 to OSHWM+&5FF

the exception of characters 91 to 95 and 123 to 126, which have been redefined. If a graphics character is required, it is selected from the user-defined characters from 128 to 159, in the same way as in the Epson dump last month.

The characters are put on the screen via the graphics cursor. The text and graphics cursors are joined (VDU5), and the cursor is positioned by a MOVE statement to calculated x% and y% co-ordinates by PROCprint ( ). Each line is scanned twice, and text characters are printed as blanks on the second scan, whereas the graphics

Program 1. The loader

```
10 REM LOADER
20 MODE7
30 *LOAD"XXXX"7C00
40 PAGE=PAGE+&600
50 CHAIN"TRANSTT"
```

Program 2. The translator

```
 10 REM TELETEXT TRANSLATOR
 20 REM G.B.HILL (c) DECEMBER 1983
 30 REM VERSION 2
 40
 50 HIMEM=&4800
 60 PROCset_up
 70 REM*** Read screen into memory ***
 80 A%=135
 90 VDU26,15,30
 100 FOR I=0 TO 999
 110 REM call osbyte with A=135
 120 !user=USR&FFF4
 130 screen?I=user?1
 140 VDU9
 150 NEXT
 160
 170 REM*** Main translating loops ***
 180
 190 MODE4
 200 VDU5
 210 FOR Y%=0 TO 24
 220 FOR scan%=0 TO 1
 230 text=TRUE
 240 base=128
 250 FOR X%=0 TO 39
 260 char=screen?(Y%*40+X%)
 270 IF char>128 AND char <136
THEN text=TRUE
 280 IF char>144 AND char <151
THEN text=FALSE
 290 IF char=153 THEN base=128
 300 IF char=154 THEN base=144
 310 IF char>127 AND char <160
THEN char=32
 320 x%=32*X%:y%=(25-Y%)*36
 330 IF scan%=1 THEN y%=y%-12
 340 IF text THEN PROCptext ELSE
PROCpgraphics
 350 NEXT
 360 NEXT
 370 NEXT
 380 VDU4
 390 REM CHAIN or *RUN dumping
program here
 400 *RUN E012
 410
 420 END
 430
 440 DEFPROCset_up
 450 DIM user 3,screen 999
 460 REM Define special characters and
graphics characters
 470 *FX20,6
 480 VDU23,128,0,0,0,0,0,0,0,0
 490 VDU23,129,240,240,240,0,0,0,0,0
 500 VDU23,130,15,15,15,0,0,0,0,0
 510 VDU23,131,255,255,255,0,0,0,0,0
 520 VDU23,132,0,0,0,240,240,240,0,0
 530 VDU23,133,240,240,240,240,240,240,0,0
 540 VDU23,134,15,15,15,240,240,240,0,0
 550 VDU23,135,255,255,255,240,240,240,0,0
 560 VDU23,136,0,0,0,15,15,15,0,0
 570 VDU23,137,240,240,240,15,15,15,0,0
 580 VDU23,138,15,15,15,15,15,15,0,0
 590 VDU23,139,255,255,255,15,15,15,0,0
 600 VDU23,140,0,0,0,255,255,255,0,0
 610 VDU23,141,240,240,240,255,255,255,0,0
 620 VDU23,142,15,15,15,255,255,255,0,0
 630 VDU23,143,255,255,255,255,255,255,0,0
 640 VDU23,144,0,0,0,0,0,0,0,0
 650 VDU23,145,96,96,0,0,0,0,0,0
 660 VDU23,146,6,6,0,0,0,0,0,0
 670 VDU23,147,102,102,0,0,0,0,0,0
 680 VDU23,148,0,0,0,96,96,0,0,0
 690 VDU23,149,96,96,0,96,96,0,0,0
 700 VDU23,150,6,6,0,96,96,0,0,0
 710 VDU23,151,102,102,0,96,96,0,0,0
 720 VDU23,152,0,0,0,6,6,0,0,0
 730 VDU23,153,96,96,0,6,6,0,0,0
 740 VDU23,154,6,6,0,6,6,0,0,0
 750 VDU23,155,102,102,0,6,6,0,0,0
 760 VDU23,156,0,0,0,102,102,0,0,0
 770 VDU23,157,96,96,0,102,102,0,0,0
 780 VDU23,158,6,6,0,102,102,0,0,0
 790 VDU23,159,102,102,0,102,102,0,0,0
 800 VDU23,91,0,16,32,127,32,16,0,0
 810 VDU23,92,32,32,32,38,9,2,4,15
 820 VDU23,93,0,4,2,127,2,4,0,0
 830 VDU23,94,8,28,42,8,8,8,8,0
 840 VDU23,95,0,0,0,127,0,0,0,0
 850 VDU23,123,32,32,32,34,6,10,15,2
 860 VDU23,124,0,36,36,36,36,36,36,0
 870 VDU23,125,240,16,32,146,102,10,15,2
 880 VDU23,126,0,8,0,127,0,8,0,0
 890 ENDPROC
 900
 910 DEFPROCptext
 920 IF scan%=1 THEN PROCprint(32):ENDPROC
 930 IF char=163 THEN char=96
 940 IF char=223 THEN char=35
 950 IF char=224 THEN char=95
 960 char=char AND &7F
```

page 80 ►

characters are selected by 'index' in the same way as in the Epson dump.

The method is not perfect. I still have not produced either colour or double-height. The latter is now possible for anyone with the patience to define the necessary double-height character set. Colour is also possible if the program can be fitted into mode 1. These refinements are left as an exercise for the reader.

There is also some distortion, principally a compression in the Y direction, but fortunately this is cured by the dumping process on many printers. The broken graphics gaps are not completely even but seem quite acceptable. The method of use for stored mode 7 or teletext screens is:

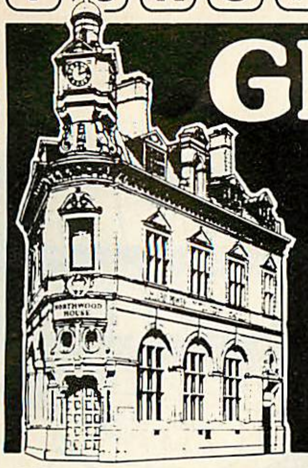
1. Load program 1 and alter the *LOAD"XXXX"7C00 line to contain the picture name.
2. Run the program. The rest should be automatic.

Note, however, that the usual precautions should be taken against Searching and Loading messages from tape: and you must include a simple on/off dump. This can be *RUN (if machine code) or CHAINed (if Basic or hybrid), or included as a procedure in the translator program. Mine was the machine code equivalent of Epatall from the December issue.

I hope this will help dot-matrix users not catered for in last month's article. ●

► from page 79

```
 970 PROCprint(char)
 980 ENDPROC
 990
1000 DEFPROCpgraphics
1010 IF scan%=0 THEN PROCgraphics1 ELSE
PROCgraphics2
1020 ENDPROC
1030
1040 DEFPROCgraphics1
1050 IF char=35 OR char=223 THEN
PROCprint(35):ENDPROC
1060 PROCswapem
1070 IF index=4 OR index=5 THEN PROCptext
ELSE PROCprint(base+(char MOD 16))
1080 ENDPROC
1090
1100 DEFPROCgraphics2
1110 PROCswapem
1120 IF index=2 OR index=4 OR index=5
THEN PROCprint(32)
1130 IF index=3 THEN PROCprint(base+4)
1140 IF index=6 THEN PROCprint(base+8)
1150 IF index=7 THEN PROCprint(base+12)
1160 ENDPROC
1170
1180 DEFPROCswapem
1190 IF char=96 THEN char=35
1200 IF char=95 THEN char=96
1210 char=char AND &7F
1220 index=char DIV 16
1230 ENDPROC
1240
1250 DEFPROCprint(c)
1260 MOVEx%,y%
1270 VDUc
1280 ENDPROC
```



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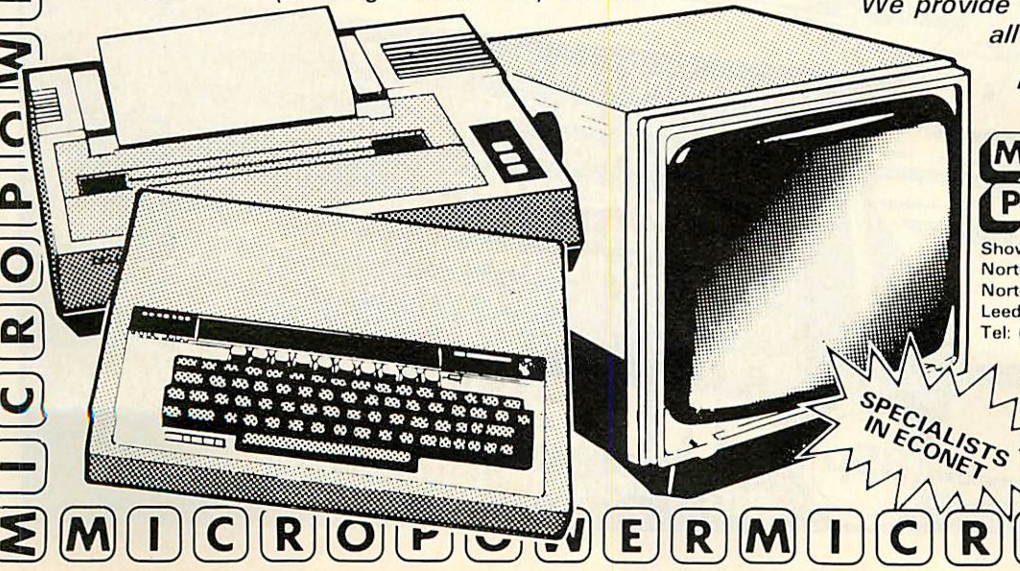
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PROBLEM-SOLVERS OF TADDLECOT

Joe Telford reviews the first major education software pack from Acorn CES. Pupil initiative is tested in the performance of simulated civic tasks

SINCE John Coll's departure last year to the MEP (*Acorn User*, October), Acorn's education division has been reorganised under the experienced eye of Maurice Edmundson, who has marshalled the company's appearances at the recent education exhibitions.

The biggest development in the shape-up has been a major new software facility, and the centring of Acorn's education wing at Maidenhead. The group aims to develop full-blown educational software in competition with established publishers, in addition to efforts made by Acornsoft.

This all began in late 1983, when Acorn bought an offshoot of the British mainframe manufacturer ICL (International Computers Ltd) called CES. This company was effectively a team of staff, plus the educational material which they were currently selling and completing. The team was situated at the Hermitage and promptly renamed Acorn CES (Computer Education Services).

The team's first major release under Acorn colours is the pack that was being completed when they were still part of ICL. Rather than being just a collection of software, this offering is a complete package of materials. It is entitled 'Computers, Information and You'.

The Acorn CES package comes in five parts:

1. A student's book
2. A teacher's (or parent's) guide
3. A set of activity sheets
4. A copy of program documentation (on tape)
5. Six programs supporting the texts.

It is aimed at children in the first years of secondary education and is best used as a complete pack, although the cost must be considered if, say, a year group is to be equipped. The complete pack is designed as a 20-hour module which can be used as a complete short course, if time is at a premium.

All the applications described in the student's book centre on the fictional town of Taddlecot and pupils are able to appreciate by illustration both the benefits and problems new technology brings. Among the residents of Taddlecot are the 'problem solvers', known as Ramley, Romley & Promley Ltd, who can be called upon by the townsfolk. Ramley, Romley & Promley may be regarded as systems analysts, although they are not referred to as such. In describing their assignments, many chapters adopt a problem-solving approach to computer applications.

In fact, pupils are introduced to problem-solving in the first chapter, while the next two examine the nature of information. The computer itself appears in chapter 4, in which the basic differences between micro and mainframe computers are described. Chapter 5 looks at some applications of robots, and chapter 7 examines the way in which computers are controlled, the concept of a program being introduced by examining instructions that we issue to both people and machines. A simple treatment of the manufacture and application of microprocessors is included in chapter 8, and this leads on to a discussion of control applications in chapter 12. The concluding chapter draws together the points highlighted throughout the book and examines some of the wider implications of information technology. Other sections of the book describe a variety of applications, including information retrieval and computer-aided design.

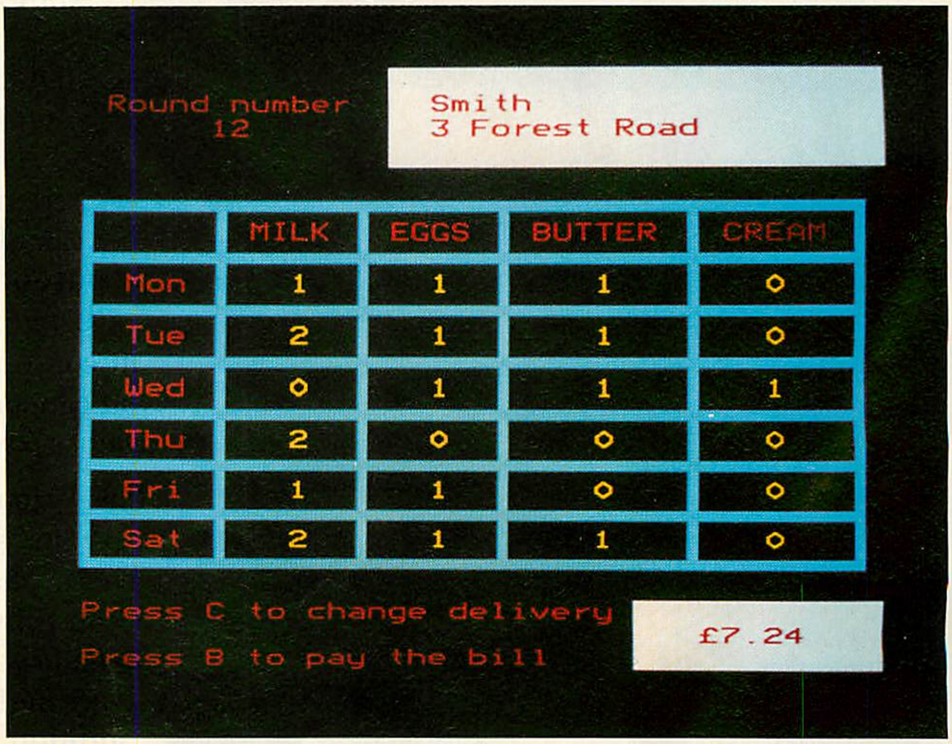
The book is well-written and illustrated with many photographs and line drawings, which should encourage children to read through it. As usual with computing texts, the reading age may be a little high for the target audience, but is closer than many similar offerings. It is up-to-date, bright, and makes exciting reading.

The teacher or parent buying the book will, of course, need to discuss many of the terms with the children, although the book gives a simple definition of every jargon word as it is encountered.

I enjoyed reading the book, as have a number of adults and young people who have dog-eared my copy over the last month or so.

The teacher's or parent's notes are collected in an A4 handbook and are of the same high standard as the student's book. The notes are in two sections. The first explains key points in each chapter for the teacher's benefit, and then gives answers

ORDER, ORDER – In the Dairy program pupils have to decide on the delivery order, keep track of accounts and make RUNning adjustments



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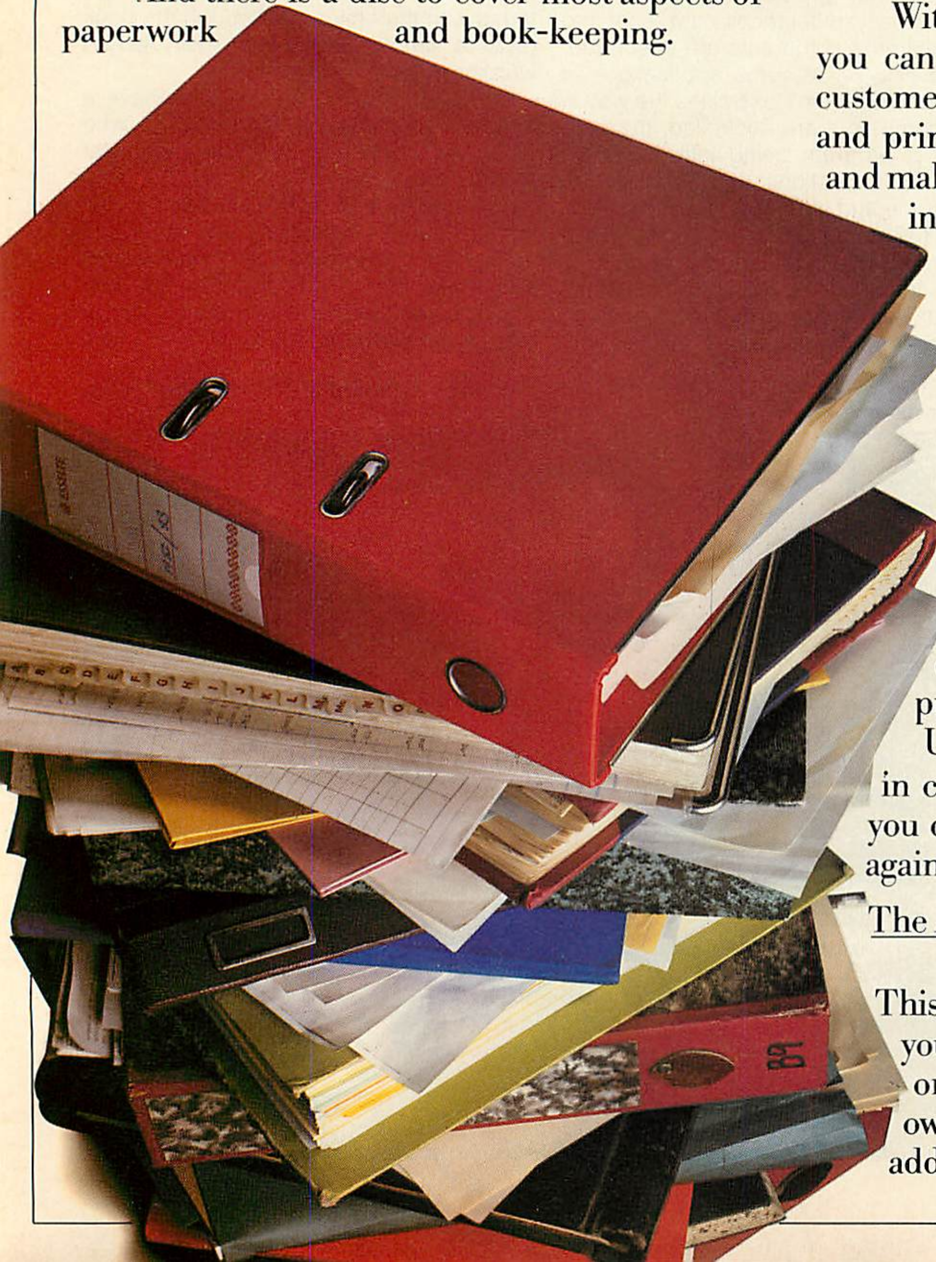
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to each question posed in that chapter. The second part explains in detail how to use the six programs.

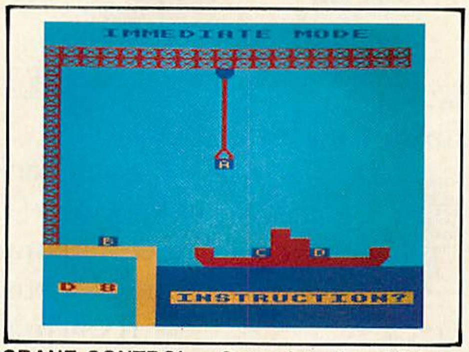
The activity sheets are a collection of single-sided A4 sheets which may be copied for class use, to be used with the programs by students at the computer. They serve the dual purpose of focusing the student's attention on the task and recording his progress. My only criticism is that teachers may be tempted to let the activity sheets do all the work and not produce any useful material of their own.

The documentation is supplied on one side of the single tape package. It can be loaded onto a model B BBC micro and displayed on screen or printed out. The tape is positioned in the recorder and rewound. Then the first program is CHAINed. This loads a further program, which performs a number of tests to set up the printer.

The documentation is then loaded and printed out on paper, if a printer is available; otherwise it is displayed on-screen. During this printout each printer is given a type number. My Olivetti ink-jet printer was regarded as type number 1, and although it reproduced two test patterns equally well, it performed line feeds only after I nominated the second pattern as correct. Users may need to experiment here.

The documentation itself is brief and obviously intended as a reference guide, although it is an alternative to the more complete documentation for those who have not bought the teacher's notes.

The program tape consists of six main programs, each prefixed with a loader program. They are not protected against copying, but each loader program must be copied to allow its companion program to run. The loader programs display a company logo (which on my version still says 'ICL'). The main programs are designed to run on model Bs with either cassette or disc filing systems, and level 1 Econet versions are soon to be available. Acorn CES wisely suggest that back-up copies be made. The programs on the tape are:



CRANE CONTROL – Cargo lets the children operate a crane

Calling program	Main program
EMERG	IT1
DAIRY	IT2
CARGO	IT3
VEHICLE	IT4
FASHION	IT5
HOUSES	IT6

As well as displaying a logo while the main problem is loaded, each calling program sets a number of system variables. This means it is important to include the calling program (and hence the logo) in any backup. Some programs allow the use of a printer and users are informed at the beginning of a run at which point they can answer 'no' or select their printer type. Pressing Escape during any program gives the opportunity to end or continue execution, while pressing Break restarts the execution from scratch. In addition a simple Help command is provided in each program by pressing the '@' key.

Emerg (Emergency), the first program on the tape, supports chapter 1 of the student's book and illustrates the computer's ability to solve complex problems rapidly.

Users are presented with three different situations in which they select one of four ambulances and direct it to the scene of an emergency. A map of Taddlecot is shown where streets are measured in time intervals (a topological map). The aim is to minimise the 'thinking' time for selecting an ambulance and the journey time for that ambulance.

After each journey the computer solves the same problem and users are invited to compare results. After the third journey, students are given the opportunity to create their own emergency situations by moving both the ambulances and the emergency to new locations.

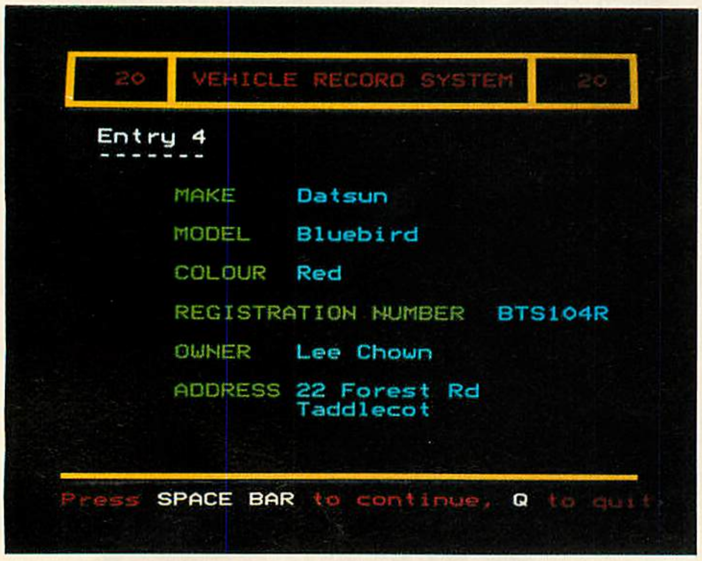
Using the program proves easy, though some teachers will prefer the sound to be turned off, as it is rather powerful. My only complaint centres on the colour scheme for the map, ambulances, emergency and chosen routes. Except for the ambulances, the graphics are all line drawings, so the effect of flashing lines on a black background is startling. I would have preferred a coloured background. However the program achieves what it sets out to do, regularly demonstrating that it can reduce the thinking time for even the fastest pupil by half, and shorten the ambulance journey by several minutes.

Dairy is the second program on the tape. Supporting chapter 3 of the student's book, it illustrates ways in which the computer can process data in order to provide information in a variety of forms.

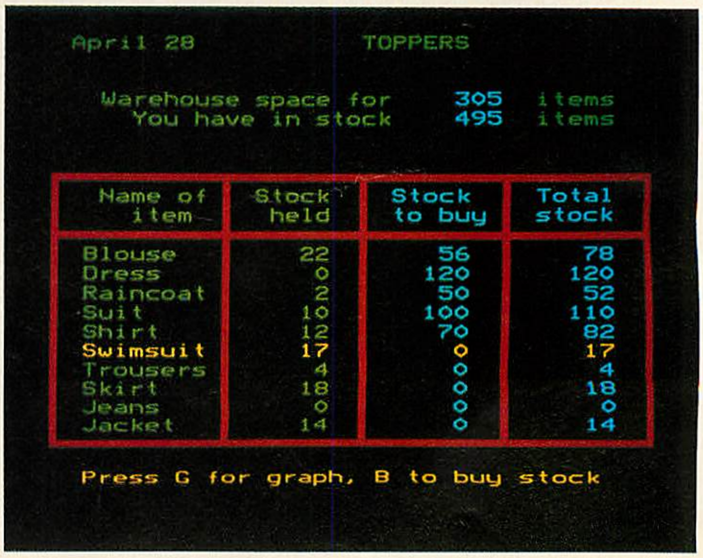
Users are shown a list of a roundsman's customers in delivery order. Then, using the map provided in the activity sheets, they must decide on an appropriate delivery order for additional customers. They can examine and update customer accounts and verify that the loading information has been altered to correspond.

This program is much larger than EMERG and weighs more heavily on the user. The pupils must drive this program, and the activity sheets are a must, in my opinion. Unlike EMERG, it is possible to get nothing at all from this program, unless previous activities have prepared the children and the teacher has explained what must be done. The program has an essentially menu-driven structure, and the sequence of menu options and the reason

WHEEL BASE – Information retrieval demonstrated in Vehicle.



RAG TRADE – Fashion is for five dedicated followers of stock control



for that sequence must be firmly established by the teacher before less able pupils use the program. The layouts are impressive, and the methods of information input are compatible with commercial practice. Another high-rating program.

The third program on the tape, Cargo, supports chapter 7 of the student's book and introduces the idea of a program as a series of instructions. Users are presented with a dockside scene in which a number of crates are to be loaded onto a waiting ship by means of an overhead crane. The crane is controlled by sequences of simple instructions and care must be taken to distribute the weights evenly on the ship. The program functions in one of four modes:

1. Immediate mode, where instructions are obeyed as they are entered.
2. Program mode, where the instructions are entered and stored.
3. Execute mode, where the stored instructions are executed.
4. Single-step mode, in which stored instructions are executed one at a time.

This is perhaps the program which will appeal to most children. The chance to operate a crane, loading cargo onto a ship, is one not to be missed. The CES team have thoughtfully provided many motivators in the program, apart from the success factor. Sound is well used and the screen display, including the mnemonics for the crane programs, well organised. A human touch has been added by allowing careless operators to sink the ship if they misplace the cargo or the crane's jaws. A good teacher will find many uses for this program and it will provide a springboard for further studies by the children.

Computers, Information and You is the first in a set of two packs in the Acorn CES series 'Living with Computers'. It is available from Acorn CES, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Enquiries to Acorn CES on (0628) 71592

Some local education authorities are purchasing a software licence for all schools in their areas, so if you are a teacher it may be best to check prices with your local Advisory staff.

Prices

Pupil's Book	£2.95 (schools)
	£3.95 (other)
Teacher's guide and activity sheets	£9.50 (schools)
	£12.50 (others)
Pack of 6 programs	£25.00

Vehicle, the fourth program, supports chapter 9, illustrating one use of a computer in information retrieval.

It contains details of more than 170 vehicles belonging to people in the Taddlecot area. Users may select vehicles according to make, model, colour or registration number, and they can use combinations of these details to select vehicles. A list of selected vehicles may be displayed, printed, and extended or refined by further enquiries.

This is another program that can be 'played with' at a superficial level, without much learning occurring. But if the teacher prepares the material properly and the children use the activity sheets there will be no problem, but simply to let the children loose on it with no pre-knowledge or aim would be wasteful. The displays are clear and understandable, and the program succeeds in simulating an *important* application.

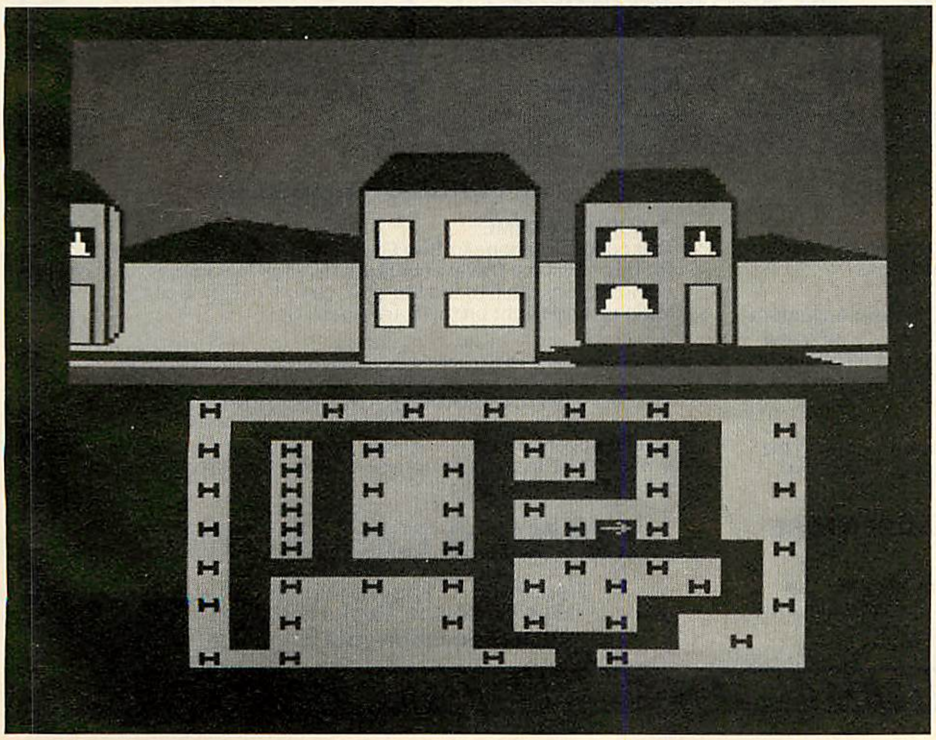
The Fashion program, supporting chapter 10, illustrates how the computer may be used to make business decisions.

It is a game played among up to five individuals or groups. The aim is to sell as many items of clothing as possible in each of six fortnightly trading periods. The only constraint is the stock-holding capacity of the warehouse. The computer can present information which the users can interpret to assist in the purchase of stock. This help is in the form of graphs showing sales trends and an updated table containing details of stock held and on order.

This program seems unassuming, even boring, at first glance, yet it covers probably one of the most important applications of computers in commerce. My own experience has been that the program tends to be used as much by the Home Economics and Business Studies departments as by the computing department of a school. Once the element of competition between teams is introduced, the program can form the basis of a range of business-type games, and there is a valuable side-effect involving the interpretation of graphs, which makes the program even more useful. The problem is that some children need a practice run before the competition, as it takes a short time to get accustomed to the key sequences.

Houses, last of the six, supporting chapter 11, illustrates the use of the computer as an aid to visualising the final stages of an as yet incomplete project. Users see a plan of a proposed housing estate in Taddlecot. By moving a pointer on the plan, they can see a variety of three-dimensional views of the estate in its completed form.

HOME KEYS – The computer as visual aid to planning in the Houses program



This program is easy to use, and aquits itself creditably as an important part of the pack. Like Fashion, it can easily be transferred into other curriculum areas, where it can be used to advantage. Despite a small problem with perspective and the fact that the Taddlecot builders have only one design of house, the program achieves its aim.

Until I saw this pack I thought that most of the exciting software was to be found in the primary age-range. Although I'm tempted to say that fourth-year junior children would get a lot from the package, I feel it is really aimed at the first couple of years of the secondary school, though teachers of older children will have a short honeymoon period of using it with their pupils in 'appreciation' courses. Although the package produces a model short 'awareness' course in information technology, it would be possible, in schools without computing departments, to share the package among departments so that it was *covered in* different areas of the curriculum. However it is deployed, the package provides a valuable 'gentleman's knowledge' of many of the applications of information technology. ●

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CALLED BY REFERENCE

John Ryding explains how variables and arrays can be passed into and out of procedures in Basic, effectively changing the procedure call to a call by reference. His technique, he believes, allows you to write more structured programs. Particular tasks, such as sorting arrays and inverting matrices, can be hived off to separate subroutines that can be written in general terms and included in any program without your needing to know details of the array to be passed from the main program

BBC BASIC is a great improvement on the standard versions of Basic found on other micros. Apart from being very fast, it is designed to promote structured programming. This article demonstrates how the BBC procedure call, already far superior to the GOSUB command from the point of view of readable code and the ability to pass the values of variables into subroutine, can itself be greatly improved.

Several articles and books have discussed the problem of how to pass variables back out of procedures. None so far has suggested very satisfactory answers. The problem arises because procedures in BBC Basic call variables by value rather than by reference. Only the values of variables are passed into the corresponding dummy variables in the subroutine. Since these dummy variables are local to the subroutine, any operations upon them leave the variables outside the subroutine unaffected. If this is unclear, try running listing 1. This program returns the value A equals 2, since A is unaffected by the procedure.

Languages such as Fortran adopt a different method for passing variables into subroutines, known as call by reference. When A is passed into a subroutine, the location in memory of the variable A is assigned to the corresponding variable within the subroutine, and thus operations on A inside the subroutine affect the value of A outside. For example, if one compiled and ran listing 2, Fortran would return the value 4.

```
10      A = 2
20      PROCSQUARE(A)
30      PRINT A
40      END
50      DEF PROCSQUARE(A)
60      A = A*A
70      ENDPROC
```

Listing 1. Variable A remains unaffected

```
A = 2
CALL SQUARE(A)
PRINT A
END
SUBROUTINE SQUARE(A)
A = A*A
RETURN
END
```

Listing 2. The value of A outside the subroutine is changed

In this simple illustrative case, the problem could be solved in BBC Basic by using a function call, which returns a single value; however, in more complicated cases, typically those involving arrays, this solution cannot be used. The ability to pass arrays into and out of procedures would be a very useful addition to BBC Basic. A procedure, perhaps a sort routine (or an algorithm for inverting a matrix), could be called from any part of the program, and sort any array (or invert any matrix). Indeed, one could maintain a library of useful procedures and use them in any program (programs can be merged using *SPOOL) without having to alter the procedure for the specific array it has to deal with.

The solution lies in somehow passing the location in memory where the array we wish to operate upon is stored. If this location could be 'attached' to an array inside the procedure, then operating on this array would also alter the array outside the subroutine.

To see how this can be done, we need to know a little about how variables and arrays are stored inside the BBC micro. Most versions of Basic store the name of each variable and its value as it is created. To find a particular variable, the computer has to search the whole Basic heap. However, BBC Basic maintains a separate list for variables beginning with different letters (upper and lower case being treated as distinct letters). An area of RAM starting from &0482 is used to store the pointers of the first variable beginning with a particular letter, two bytes for each. For example, &0482 and &0483 contain the least significant byte (LSB) and most significant byte (MSB) of the address of the first variable beginning with the letter A. Thus the address of the first variable beginning with A is given by (? &0483)*256 + (? &0482). The formula to determine the pointer to the LSB of the first variable beginning with any letter, A$, is:

2*ASC(A$) + &0400

At the address given by the pointer is the LSB of the address of the next variable beginning with A$, with the MSB in the next address. Then follows the name of the variable (excluding the first letter), including % or $ if relevant, and an open bracket in the case of an array. The end of name is marked by a zero byte. After this follows details about the dimensions of the array (if any) and the data. For example, if an array called ARRAY (.,.), was located starting at address &6000, then memory from this location would contain the information detailed in table 1.

The routine to pass an array by reference into a subroutine works as follows (listing 3). Pass the array name into the subroutine as a character string (including $ or % if relevant). The example is a routine which reverses the elements of an array. Inside the procedure, call a function (FN pointer)

Memory location	Contents of location
&6000	LSB of address of next variable beginning with A
&6001	MSB of address of next variable beginning with A
&6002	ASC ("R")
&6003	ASC ("R")
&6004	ASC ("A")
&6005	ASC ("Y")
&6006	ASC ("(")
&6007	0 (end of name marker)
&6008 and onwards	Details of dimensions and data

Table 1.

to search for the address of the start of this variable. This function works by starting at the pointer for the address of the first variable starting with the same letter as the array name (line 270) and searches through the variables beginning with this letter until the array is found, or the list is exhausted (lines 280 to 370). If the array exists, the memory location of the array three bytes lower in memory than the end of name marker is returned, or four bytes lower if the array is a string or integer array (lines 360 and 380). The LSB and MSB of this address can be poked into the memory locations for the pointer to the first variable beginning with another letter (in the example x is used, see lines 160 to 180), and the array can now be referred to as x (.,.) in the procedure.

In this example (suppose that ARRAY (.,.) was stored from &6000 onwards as in table 1) the x pointer will be set to &6004, so that the memory is in the correct configuration, ie &6004 and &6005 are set aside to contain the address of the next variable beginning with x, and &6006 contains the rest of the array name "(".

If you enter and run listing 3, you will see that the array has been re-ordered, proving that we have passed ARRAY by reference. There are some points to note about this listing.

First, since the pointer to the first variable beginning with x has been altered in PROCreverse, any variables or arrays in the main program beginning with an x have been lost. There are two solutions to this: one could use a modified version of FN pointer to find the last variable beginning with an x, and place the address for ARRAY in here; alternatively, unless we want to pass a variable by reference beginning with x, we could add:

165 LSB = ? start: MSB = ? (start + 1)

which would store the address of the current x pointer, and

235 ? start = LSB: start ? 1 = MSB

to replace the original pointers at the end of the procedure.

Second, the routine can be easily modified to pass non-array variables, by including the open bracket when passing arrays. One would have to modify line 370, then exclude + "(" since this is now included in the procedure call, and alter line 380 to place point to the correct location (you might like to try this as an exercise to check your understanding of the article).

Third, any letter can be used to represent the array(s) passed, by altering the parameter in the FN start call.

The techniques presented in this article show how one can greatly improve the BBC PROCedure call. If you use them, you will be able to write many of your programs with greater clarity than previously. It is only a shame that calls by reference were not included in the Basic itself, so that one did not have to, resort to such measures as those presented here. ●

```
   10 REM Routine to pass
   15 REM variables by reference
   20 REM into procedures
   25 REM by John Ryding.
   30 REM Acorn User (1984)
   40  DIM ARRAY(5)
   50  FOR I=1 TO 5
   60    ARRAY(I)=I
   70    NEXT I
   80  PROCreverse("ARRAY",5)
   90  FOR I=1 TO 5
  100    PRINT "ARRAY(";I;")=";
ARRAY(I)
  110    NEXT I
  120  END
  130  DEF PROCreverse (A$,n)
  140  LOCAL point,start
  150  point=FNpointer(A$)
  160  start=FNstart("x")
  170  ?start=point MOD 256
  180  start?1=point DIV 256
  190  FOR I=1 TO (n/2 DIV 1)
  200    TEMP=x(n+1-I)
  210    x(n+1-I)=x(I)
  220    x(I)=TEMP
  230    NEXT I
  240  ENDPROC
  250  DEF FNpointer(X$)
  260  LOCAL loc,address,point
  270  loc=FNstart(X$)
  280  REPEAT
  290    address=?(loc-1)*256+?
loc
  300    IF address?1=0 THEN PR
INT "Array ";X$;" does not exis
t":END
  310    loc=address : Y$="" :
address=address+2
  320    REPEAT
  330      Y$=Y$+CHR$(?address)
  340      address=address+1
  350      UNTIL ?address=0
  360    point=address-3
  370    UNTIL Y$=MID$(X$,2)+"("
  380  IF RIGHT$(X$,1)="$" OR R
IGHT$(X$,1)="%" THEN point=poin
t-1
  390  =point
  400  DEF FNstart(Z$)=2*ASC(Z$
)+&400
```

Listing 3. The array is passed by reference

SPICE FROM SPRITES

All aboard – sprites, turtles and pixels! But Malcolm Banthorpe finds no bugs in Computer Concepts' Graphics Extension ROM

THE Graphics Extension ROM is the latest piece of firmware from Computer Concepts to follow the Wordwise, Beebcalc and Disc Doctor chips.

Many programmers must have noticed, when consulting the *User Guide* on such topics as the PLOT command, that certain codes have been 'reserved for future expansion' and wondered when some enterprising company would get round to producing a graphics extension ROM. (Acorn's promised version not having been heard of since 1982!). There must be a good reason for those apparently useless extra zeros in the VDU19 command.

The Computer Concepts ROM contains many of the facilities that might have been expected in such a product, although it doesn't make use of the reserved codes.

While the graphics commands in the Beeb's operating system and accessible from Basic are probably more extensive than in any other machine of its class, several features could have been usefully added if there were space. This ROM goes some way to filling the gaps and provides a number of facilities not generally found elsewhere.

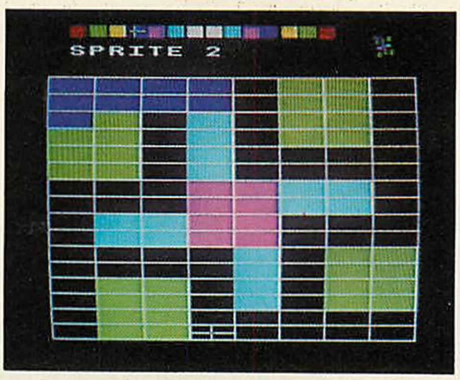
Some sort of circle-drawing command is now quite common on other home computers. Although most people who have done graphics programming will know at least one way of writing a suitable procedure, it is undeniably much more convenient to be able to simply type

```
*CIRCLE 640 512 300
```

to draw a circle of radius 300 at the centre of the screen. The speed of drawing is probably considerably better than could be achieved with any Basic routine. The price of this convenience is that any programs incorporating these new commands will not be transportable to a machine not equipped with the ROM.

All the commands, with one exception, are preceded by asterisks, as is normal with commands that are directed through the operating system. All are accessible either directly from the keyboard or within a Basic program. As with all operating system calls, there must be no other Basic statements on the same line, with the exception of a 'MODE 8' command, which is used just as the normal Basic MODE statement.

As its name suggests, it gives you an extra graphics mode. The resolution is lower than the existing ones at 80 by 256 but it allows the full 16 colour (eight flashing) to be displayed simultaneously, while the screen uses only 10k of memory. A possible use would be for a game that requires more than four different colours



and also occupies more program and data memory than the 8k or so that would be available in mode 2. Text in this mode appears as 32 lines of just 10, rather fat, characters.

Apart from mode 8 the ROM offers 29 new commands and a useful *HELP function which can be called upon as a reminder of the syntax which of any of the commands expects. Abbreviations, ending in a full stop, are permitted and could be useful in saving memory, since these commands will not be stored in a tokenised form, as Basic keywords are. If you make a mistake in using any of the commands, there is a fairly comprehensive list of error messages and, where appropriate, the correct syntax will be pointed out.

Commands can be divided into three groups: sprites, turtle graphics and general-purpose.

Several home computers offer hardware-based sprite graphics that allow small shapes to be moved rapidly around the screen. In this ROM 11 commands allow the creation of sprite characters and use software to move them around the screen. Software sprites cannot be moved as quickly as their hardware counterparts but allow Basic programmers to spice up games that otherwise require machine code to achieve speed and smooth movement.

Sprites differ from ordinary user-defined characters in that each may contain any selection from the available colours of the graphics mode in use, rather than just a foreground and a background colour. It is theoretically possible for a mode 2 sprite to contain all 16 colours. It may be up to three characters wide by three characters deep (24 by 24 pixels) and there can be up to 32 different sprites. Initially the command *RESERVE sets aside a section of memory, normally just below the screen area, to hold the sprite definitions. The manual gives instructions for estimating how much memory you need to reserve, taking into account the number and size of the sprites and which mode you are using.

The command *DESIGN, which takes a sprite number and its size as arguments, draws a grid of the appropriate dimensions and a palette of the available colours. Sprites are easily created, using the keyboard to move a colour-selecting cursor and to fill the squares that correspond to individual pixels. Figure 1 shows a mode 2 sprite in the process of being defined. The sprite is displayed actual size at the top right-hand corner of the screen.

Up to 32 different sprites can be defined and stored. *IN and *OUT are used to position them on the screen and to remove them. When a sprite is to be moved you don't have to delete it from its existing screen position before re-plotting it. The *IN command will simultaneously erase it from its old location before re-drawing it.

If you need to leave a permanent image of a sprite at a particular screen location the command *IMAGE can be used.

*FILM allows a sequence of up to 47 sprite numbers to be specified. Subsequently, each time that particular film number is called, the next sprite in the sequence is plotted. The sequence will repeat after the last item has been displayed, a convenient way of setting up simple animated sequences. For instance, two or three slightly different space invader sprites displayed in quick succession can give the effect of moving arms, legs, eyes, etc. Once the basic shape of a sprite has been designed, *ALTER allows slight variations of this type to be rapidly incorporated into new definitions without having to enter the whole shape again.

The main use of sprites is in games, but they can be more generally useful for the display of the cursors and symbols (or, to use a fashionable word, 'icons') that need to be moved around the screen. Their main limitation as implemented in this ROM is that their horizontal position can be defined

only to the nearest screen byte. As a result, in mode 1 they move across the screen in four-pixel steps and in mode 2 in two-pixel steps. The effect is that while smooth vertical movement is possible, some slight jerkiness is apparent on horizontal and diagonal movement. This should not detract too much from their effectiveness and is a minor deficiency considering how easy they are to define and move quickly, with a single command, from Basic.

Using a FOR...NEXT loop, I found that four 3×2 sprites could be moved 1,000 times in just under 40 seconds in mode 1. Put another way, four sprites can be moved in 1/25th of a second or one television frame. This, of course, does not allow for any other processing between moves (which a game or any other program would almost certainly require) but gives an idea of the speed possible. Smaller sprites take less time to move.

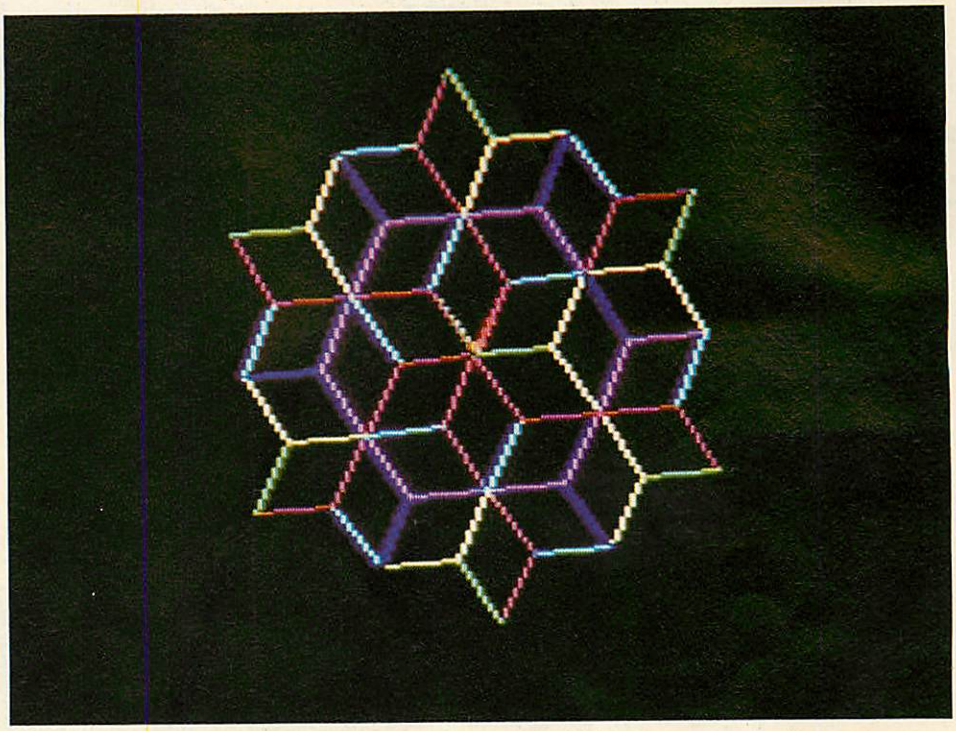
*DATA will return information about any or all of the sprites and show how much reserved memory is free. It returns such information as the memory location of each sprite definition, the mode in which it was defined, and its size. *RESET deletes any or all definitions. Two more commands allow a set of sprite definitions to be saved and loaded on tape or disc.

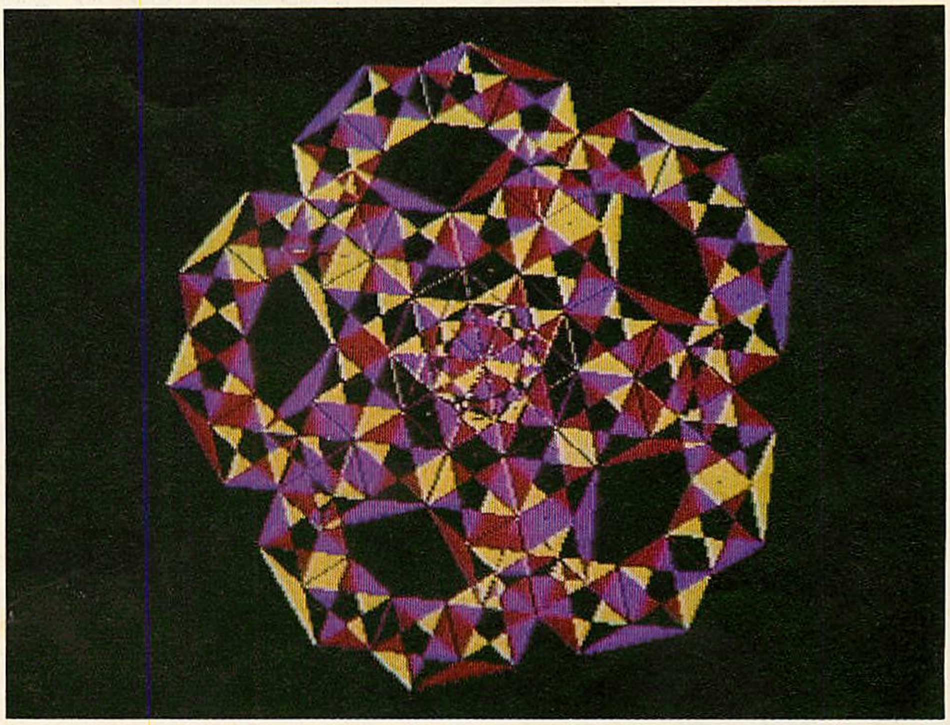
A function often found with hardware sprites but conspicuously lacking here is one to detect collisions between one sprite and another or between a sprite and other screen objects. It will be needed in some form for most games but poses no real problem as the exact location of each sprite will be known, and only a little programming will be needed to monitor the hits.

Like the *CIRCLE command mentioned earlier, the luxury of having all the commands available directly from a sideways ROM will have considerable appeal. In this form, the only extra memory required is for the sprite definitions themselves – an important consideration when using modes 0 to 2.

The second and smallest group of commands is concerned with 'turtle' graphics and is probably best considered as a useful alternative to the normal Basic plotting commands. Instead of specifying the end co-ordinates of a line, you merely specify its length and direction. In this way it is easy to generate complex geometric patterns without having to think of the co-ordinate geometry involved.

As the 72-page manual mentions, one of the main reasons for the increasing popularity of Logo in education is its use in turtle graphics. As all the commands can be entered directly from the keyboard, people with no programming knowledge can draw simple shapes on the screen by typing familiar words such as FORWARD, BACKWARD, RIGHT and LEFT. These commands can also be used to advantage within programs to draw more complex shapes. For instance, a procedure to draw a hexagon of side length L%, starting at screen co-ordinates X%,Y%, could be:





```
1000  DEFPROChexagon(X%,Y%,L%)
1010  *POS X% Y%
1020  FOR SIDE = 1 TO 6
1030     *FORWARD L%
1040     *RIGHT 60
1050  NEXT SIDE
1060  ENDPROC
```

*POS moves the turtle to a starting point. Although it is not normally possible to pass variables to operating system commands, this ROM allows the integer variables A% to Z% to be used as arguments. At first I assumed this would mean that only the system variables A% to Z% could be used. In fact, as the above example demonstrates, local variables with these names are also permitted.

There are also advantages to be gained in using turtle graphics when you're required to rotate a shape. For example, once a hexagon has been defined as above, you need only change the initial angle of the turtle to rotate the whole hexagon around the starting point (the ROM also provides a more general means of rotating the screen display around any point – see later).

The turtle itself is displayed as an arrow shape whose size, proportions and colour may be set using a *TURTLE command, although if maximum plotting speed is required the turtle does not have to be

BE THE WAR LORD

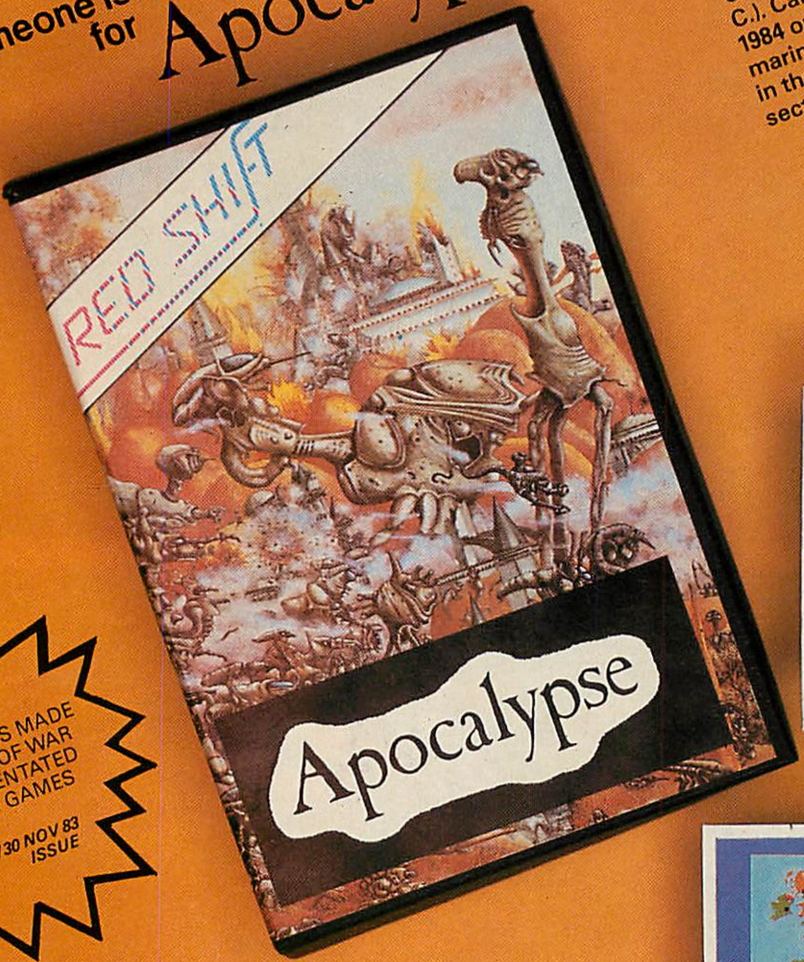
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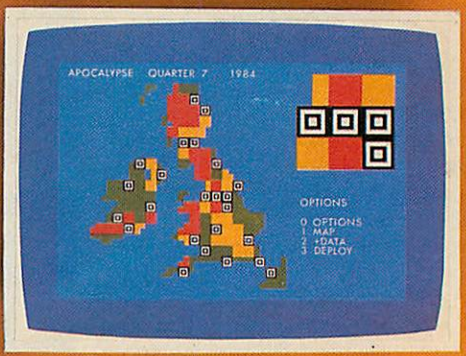
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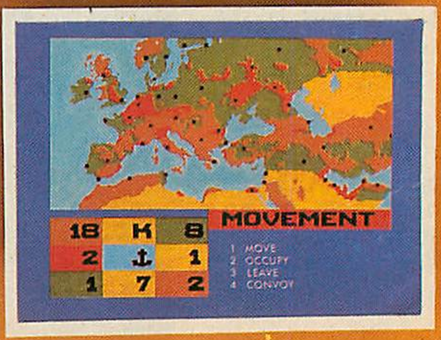
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displayed. A further parameter of the *TURTLE command determines whether the trail left by the turtle is a solid line or composed of dots or triangles. Figure 2 shows a fairly typical turtle graphics pattern. I haven't come across the ability to leave a trail of triangles in turtle graphics before. It can produce some interesting effects such as in figures 3, 4 and 5, in which I have also used EXCLUSIVE-OR (GCOL3,...) plotting.

The other commands in this section are *PENUP and *PENDOWN, which determine whether or not the turtle leaves a trail when it is moved.

The third and largest group, and the one which I found most useful, is composed of general purpose commands.

*SCALE allows the scale of all of the normal Basic plotting commands to be varied. For example, the statement

```
*SCALE 0 0 100 100
```

would make all subsequent plotting commands behave as if the bottom left-hand corner of the screen were location 0,0 and the top right-hand corner location 100 100. therefore

```
MOVE0,0:DRAW100,100
```

would draw a diagonal across the whole screen. This is not the same as using the co-ordinates of the two corners to define a graphics window, as when using VDU24. Effectively, it uses the whole screen to display what would be contained in a window defined by VDU24,0;0;100;100;. The horizontal and vertical scaling do not have to be the same and so the shapes can be squeezed and stretched. The manual says the screen size should not be defined as smaller than 12×12 or larger than 31000×31000. This gives a potential 'zoom' ratio of over 2,500 to 1. Some possible uses that spring to mind include the display of maps or diagrams that can be examined in greater detail by zooming in on the area of interest. As long as the screen is redrawn after each *SCALE statement, using standard Basic plotting commands, this should be achievable.

Another possible use is as an aid to drawing detail when a joystick, graphics tablet or other graphics input device is being used. Small areas requiring accurate detail could be temporarily scaled up while the detail is entered and then restored to their intended size. Again, it doesn't seem to involve much additional programming. The manual nicely demonstrates a similar use with a program for a simple graph drawn using various scales.

*ROTATE will rotate anything subsequently plotted on the screen by a given angle around any point. So

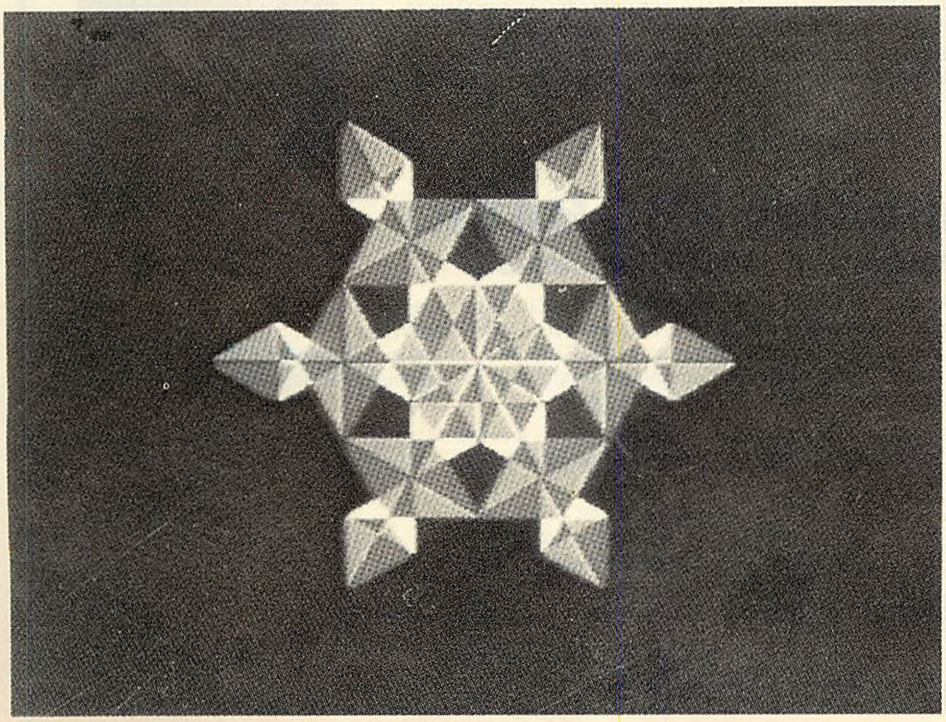
```
*ROTATE 30 640 512
```

before plotting would give the effect of the whole screen having been rotated by 30 degrees around its centre point. Together with *SCALE it could be useful in computer-aided design and drawing programs. Neither this nor the previous command affects sprite shapes but will affect the position at which they are plotted. Nor do they affect display of normal text.

*PIXEL allows larger-than-normal pixels to be plotted. Both the width and height of what are effectively solid rectangles, can be varied. If the size parameters are omitted the size will be appropriate to the screen scaling. So

```
*SCALE 0 0 80 64
*PIXEL 40 32
```

would plot at the centre of the screen a 'pixel' whose width was 1/80th of the screen and whose height was 1/64th. Width and height are also affected by *ROTATE.



*PRINT allows text to be printed in any defined size on the screen. It is affected by *ROTATE so that sloping or vertical text is possible – useful for labelling graphs and diagrams. Non-standard GCOL parameters can be used to give patterned lettering, though experiment is needed to find out what will give the desired effect.

*CIRCLE, as mentioned, allows circles to be drawn rapidly. *ARC complements it by allowing arcs and parts of circles to be drawn. It can also be used to draw what the manual refers to as ovals but which appear to be true ellipses.

*FILL is a command for filling complex shapes. BBC Basic has the PLOT81 and PLOT85 type commands for filled triangles and these can be adapted for filling some other shapes. *FILL will fill an area of any shape as long as it has an unbroken boundary of a colour other than that of the starting point. Even a small break in the boundary results in the fill colour 'leaking out'. It is slow in action, depending as much on the size of the area to be filled as its complexity, but is faster than equivalent Basic routines.

*PATTERN is described as 'a complex routine allowing a large variety of patterns to be drawn'. It behaves in some ways like a compound turtle command and takes up to six arguments. It has the property of not terminating until the graphics cursor returns to the starting point. I used

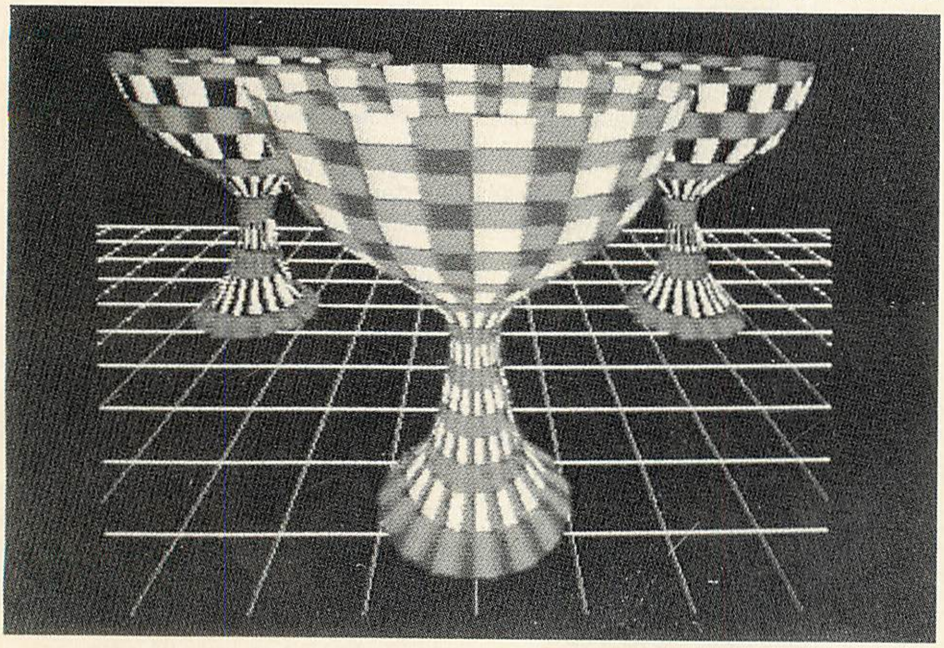
```
*PATTERN 5 640 512 500 300 1
```

to draw the ellipse in figure 6. By changing the last argument, an angle step, to 72, a pentagon was drawn that fits inside the ellipse exactly. Substituting 120 produced a triangle, which also fits exactly inside the ellipse. Spirograph-type patterns are also possible by using angle steps that don't divide exactly into 360 degrees so that the pattern goes through several revolutions before it terminates. One of the other variations I found useful was as a rapid method of drawing filled circles and polygons.

*PLOT takes four arguments, consisting of an operator, which determines the type of plotting, and three co-ordinates. It is used to draw projections of three-dimensional lines, points and triangles. The ease with which it can be used encourages experiment with wire-frame representations although, as with all 3D graphics, the initial task of working out all the co-ordinates can be tedious. More solid-looking shapes are possible if 85 is used as the first argument. Figure 7 shows a series of random vertical and horizontal planes drawn with this command. Figure 8 is a less abstract-looking example of how it can be used, involving a longer program. Here I avoided having to estimate any co-ordinates of the main shapes by letting the program calculate them from SIN and COS functions.

*GFX is a multi-purpose graphics effects command used to return various pieces of information about the other commands. Its

exact function is determined by the arguments used and the information returned in the integer variables A%,B%,C%,D% and E%. For instance, the Basic POINT command cannot be used to read the colour of one of the large pixels but a GFX command will return the value. Included also are fast SIN and COS functions that could be particularly useful in conjunction with the *PLOT command for 3D rotation.



The manual, like earlier examples from Computer Concepts, is well laid out and describes all the commands clearly and fully, giving plenty of programming examples to illustrate the effects. There are also details of what RAM is used by the ROM. Memory from &C00 to &CFF is used as workspace. This would normally be reserved for user-defined characters but there is a GFX command to reserve an alternative section if these are required at the same time as the ROM facilities. For games or other programs that make use of &C00 to &CFF the ROM can be disabled with a *FX command.

Altogether, despite the minor limitations mentioned, this is an excellent package. With the exception of the sprites, for which machine code would be essential, most of the functions available could be written by a reasonably competent programmer in Basic, although they would run more slowly. More importantly, an attempt to implement more than a few of them in a mode 1 or 2 program could use up a significant chunk of the program memory.

Anyone writing graphics programs on the BBC micro (and still waiting for the second processor) is likely to be restricted by the limited program memory. With such a useful set of commands in a sideways ROM there is less constraint upon what can be included in a program and fewer compromises have to be made. Those with more limited programming experience will find that they have instant access to a host of graphics effects that they would otherwise find difficult to achieve.

In six weeks of use I've been able to discover no bugs and everything worked as described in the manual. The addition of this ROM to the Beeb considerably enhances the graphics facilities of an already exceptional machine. ●

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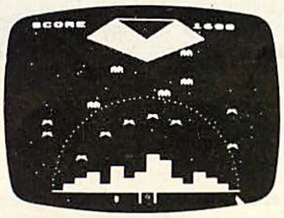
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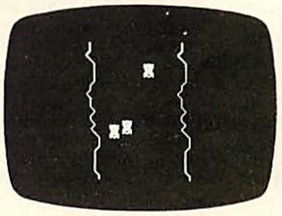
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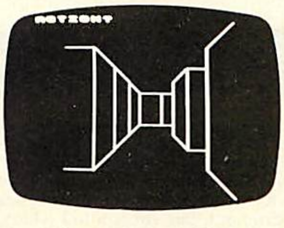
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This is the one that everybody has been waiting for. The original REPLICA set a very high standard and many said that it could not be improved. The specification that we set our chief programmer included some supposedly 'impossible' features. In fact ACORN state that some of the things that we have done are impossible, it just took us a little longer that's all. REPLICA II will transfer most of your cassette based programs to disk, even more than REPLICA did. Now when you buy disk drives you do not have to throw away your expensive cassette based programs. REPLICA II will transfer 'LOCKED' programs, programs loading as files, programs that load below &E00, those with up to 6 sections and those up to &6E in length eg adventure programs. No more waiting for 6 minutes whilst your adventure programs load. REPLICA II is very easy to use and the user just enters a name, how many sections and whether CHAIN, *RUN or *LOAD is used to load the first section. Press play and let the program do the rest, even a menu. You cannot afford not to have a REPLICA II, think how much it will cost you to buy just 1 disk version of your favourite program – it is probably more than REPLICA II which will hold up to 16 programs, limited only by the disk capacity.

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CHILD'S PLAY

It's a waste of the computer's huge potential to use it as a drill sergeant. Barry Holmes and Steve Fletcher prove the point in assessing the various benefits of five simulation packages from Ginn

HOW do computers fit into primary education? This question has tested decision-makers for several years, although at least one consensus is *appearing* – that just practising skills is too narrow an application for such a versatile machine.

One neglected source of opinion is the children themselves, some of whom hold strong views.

'That's pitiful!' exclaimed one of my fourth years, while watching a spelling program demonstrating this aspect of using computers. The program was a poor example of a skills practice program, but typical of many currently available.

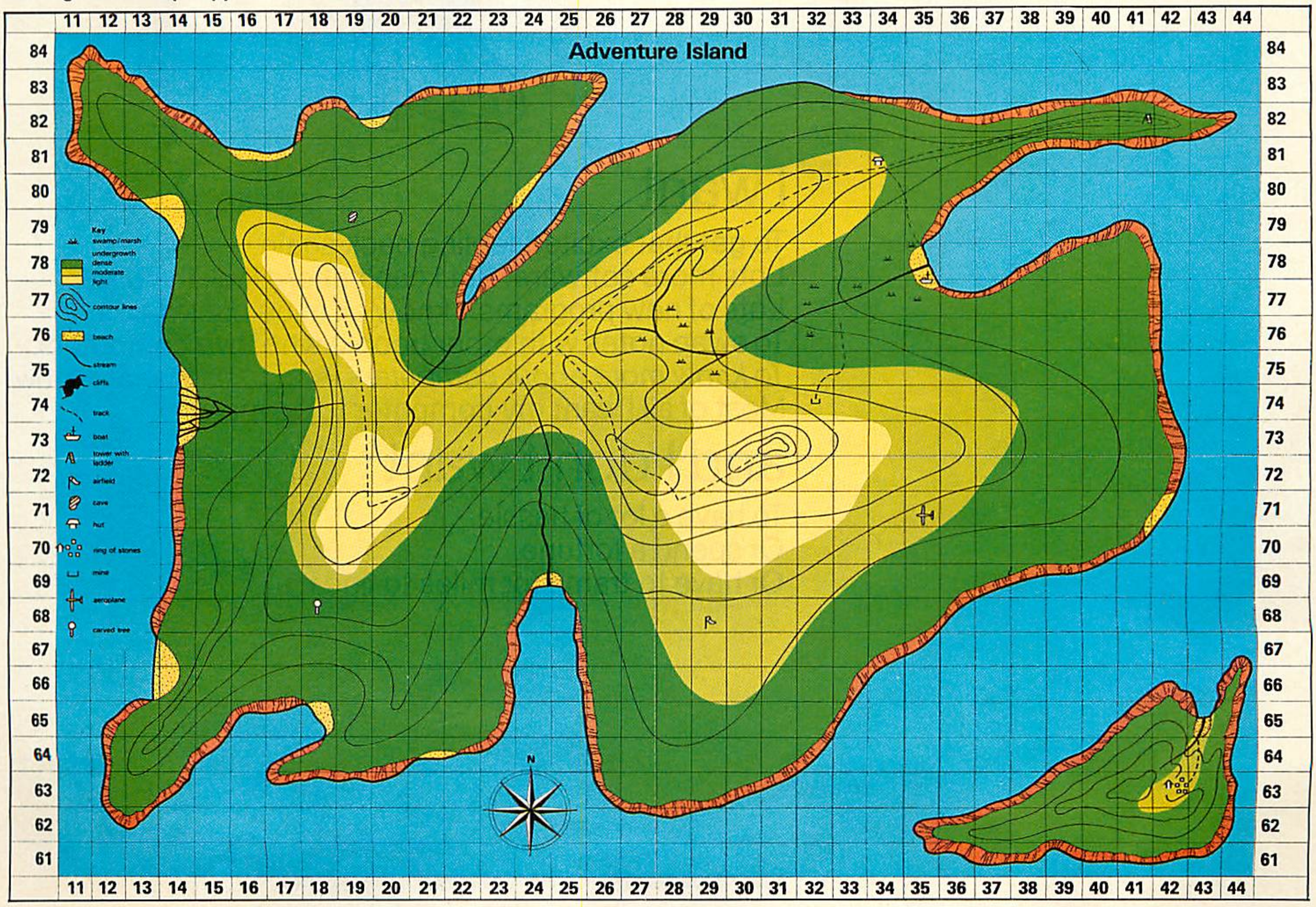
Now using the computer to practise tables and spelling is not to be decried as it can provide the motivation and stimulation many children need. However, time spent on these activities can destroy the real potential and benefits of the micro.

As home computer programs become more sophisticated, so will the judgment of children – who often have more experience than adults of sitting at the machine and know more about the range and quality of software. The child does not perceive the micro simply as a tutor, but more as a tool to explore and investigate the world. This has led us to believe that one of the major influences of computers is in the area of simulations.

What is a simulation? It is generally thought of as a model of a 'real' situation, which can be analysed, the various components examined, and a set of rules devised. The way in which the elements or actions affect the flow and sequence of the activity and the consequences of various inputs must be examined and tested. Devising a simulation requires careful analysis to ensure the model resembles the actual conditions as closely as possible, given the limitations of the computer and the conceptual ability of the children.

When we started examining simulations some four years ago, they appeared to be confined to the higher levels of education. Their use in modelling scientific experiments allowed hypotheses to be tested without a large number of time-consuming experiments. Further examples found in the commercial field are now almost historic: 'Star Trek' and 'Lunar Lander' are classic examples, both modelling space flights, one based on reality, the other on imagination. They contain an element of role-play, and require decision-making and skills which have been or are being learnt,

The large-scale map supplied with the Adventure Island program



Sometimes even the best of friends need something new to say to each other...

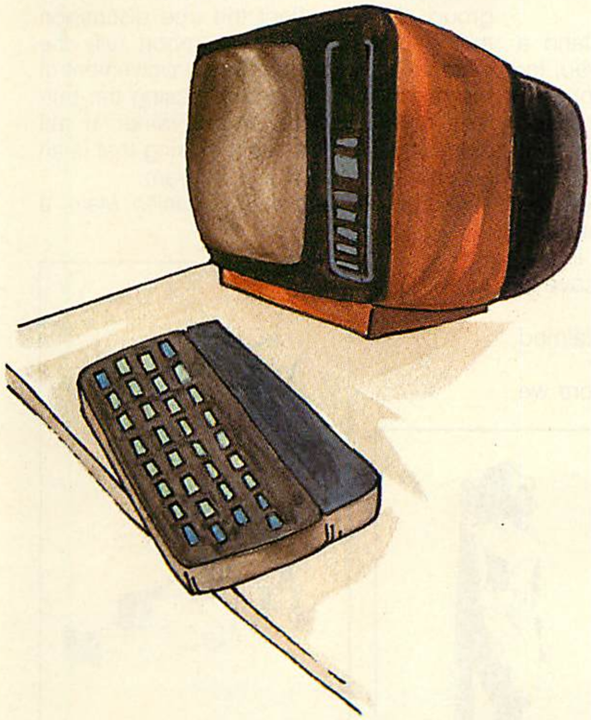


“I want

To get that excited feeling back again.
Lots more software. But I can't afford it all the time.
Lots of new programs. I know all mine backwards.
To swap notes with other people who love computers.
To know more about computers. And to use what I know.
Most of all I want my computer to do more!

and I don't want

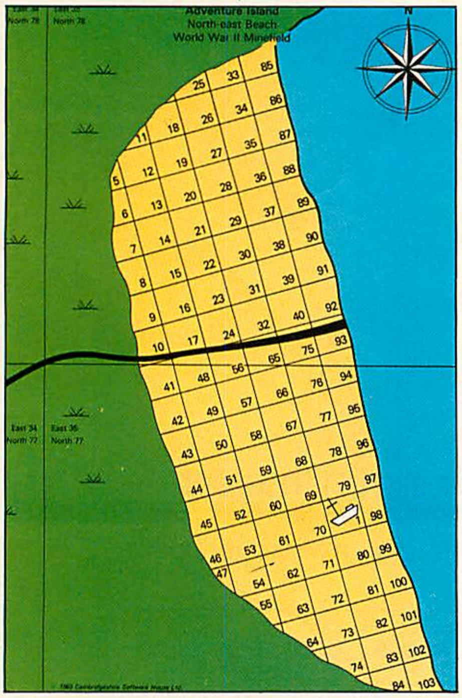
To have a lot of hassle.
Or spend a fortune.
Or have to tramp for miles to find it all.”



independently of the program.

Landing a lunar module may be fun, but the reasoning and mathematics involved put this activity beyond the scope of most primary children's comprehension. Yet they enjoy playing the 'game' and some gain an uncanny proficiency even though they are not working to any mathematical formula, and decisions seem to be based on intuition.

How, or whether, to use a model with young children depends on their appreciation of a situation and must relate to their conceptual understanding. Simulations often demand prolonged activity and 'getting the feel' for an idea, so developing strategies and the motivation to become involved is paramount. A computer is essential for these activities because its speed of reaction means the project does not become too time-consuming and inefficient.



Local map of Adventure Island's mined North-east beach

Let's examine one adventure simulation and the questions that arise.

'You have found some tapioca,' reads the message on the screen. 'What is tapioca? How would you prepare it for eating?'

The answers to these two questions are certainly not: 'It's the "frog-spawn" we have for school dinner. You open the tin . . . etc.'

These two questions are among the many posed in one simulation, devised by Ian Whittington, called *Adventure Island*. The children, in groups of four, have to survive the rigours of this fictitious island, exploring the various features in an attempt to escape or summon help.

First, the children write a short story describing the events which led them to be marooned on the island. Then they must choose five items of equipment from a limited list to aid their survival: first aid kit; nylon cord; knife; mirror; box of matches; magnifying glass; shovel; axe; five-litre water container; magnetic compass.

Then, starting from a predetermined position, they begin their exploration of the island, using a large-scale map as a reference of their position and guide to the features on the island. An integral part of the project is keeping a daily diary of the group's experiences on the island, as a part of a creative writing exercise. They also need to research the various 'finds', such as tapioca. They may have to decide, if they have taken a first aid kit, which medicine they need to administer should one of the group suffer from ailments such as heat exhaustion.

As they progress around the island a variety of problems need to be solved; for example, they may need to decipher a mathematical sequence or morse code message. They will also be faced with many dangers and dilemmas.

For instance, a group working on the program was attacked by a wild boar and Claire was injured. The two boys in the group were intent on travelling to a cave to gain shelter for the night.

'But if we carry on I'll die,' exclaimed Claire.

'No, we must reach the cave before we rest for today,' determined the boys, more concerned for their own safety than Claire's plight.

Amanda, who had been concentrating on the map, joined the conversation: 'Claire will never make it! She has only 48% fitness now, and to go to the cave takes us up a steep climb; look at the contour lines.'

She pointed the route out on the map.

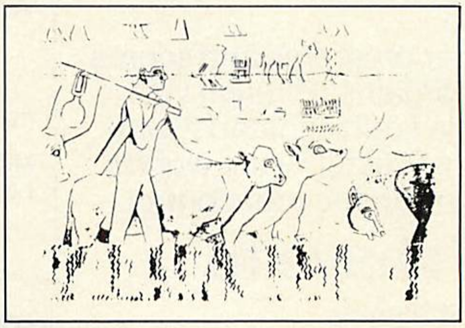
A heated discussion of the route and of Claire's health then took place, with the boys finally agreeing. 'Okay, we'll stop for the day and let her recover.'

Unfortunately, the diary produced by the group did not reflect the true discussion that had taken place or report fully the incident with the boar. The involvement of the group was not with pressing the buttons on the computer but rather in the discussion and decision-making that is an essential element of the program.

Another simulation is *Spanish Main*, a

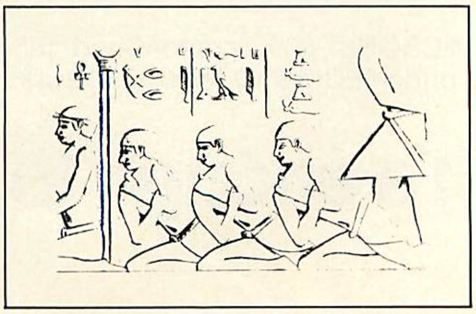












scenario of pirates searching for a treasure galleon. This is designed specifically for primary children. The program involved logical thinking related to planning, strategy and group co-operation, with groups having tasks independent of, but still affecting, the actions of their opponents.

The simulation caters for two crews of four children each, sailing their galleons around a fictitious area of the Caribbean. The pirates have the task of capturing the treasure ship on the open sea. The other crew, while collecting treasure from various islands, have to avoid capture. The direction of the wind, the amount of booty on each island and on the treasure ship, all affect the decisions and consequences of the children's actions. The main problem for the pirates is to gain information on the whereabouts of the treasure ship, as each group comes to the computer in turn and initially has no information about the other group.

Information is acquired by visiting port and is given in terms of the amount of booty on board the treasure ship and, if it had visited that port, the direction it left in. The treasure is shown as chests of gold and bags of jewels. This pair of numbers enables the pirates to calculate the ports the ship had already visited and thus calculate where it might be heading. Each group is given a map on which to plot moves and to use in their discussion while awaiting their turn.

Thus the computer is used for information storage, retrieval and processing and acts as an overall judge. Children are expected to take into account several factors, such as the direction of the wind, the direction of travel and thus the likely outcome, in their general strategy.

As with most good simulations, most of the planning and work is done away from the computer. In the above case it takes the form of some fairly heated discussion about tactics, some of which can be extremely devious.

The way children and teachers reacted to all this confirmed my belief not only in the place of the micro in the primary school but also in the potential of simulation. This faith has been further strengthened during the past three years.

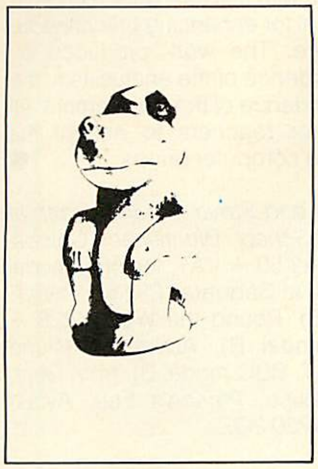
In another simulation, *Expedition to Saqqara*, children are sent on an archaeological expedition to Egypt. Before commencing the program, they must write letters to the Department of Antiquities in Cairo for permission to dig at Saqqara and to universities applying for grants. The children work in groups and each child keeps a diary of events on the site.

On arrival the children have to survey their area. Each group's survey is plotted on a master plan of the area and information is shared as it is discovered. The computer will inform them if they find evidence of a possible site. This may be 'pot shards' scattered over the surface, or 'sand dampness' indications, each suggesting something worthy of investigation. They will also meet landmarks such as the Step Pyramid of Zoser or the Causeway of Unas.

Saqqara is a real place and the site has been carefully excavated, so the simulation must be as accurate as possible. The indications of a site are those an archaeologist would look for and they are in the 'right' place. The information has been researched with the help of Professor H. Smith of London University.

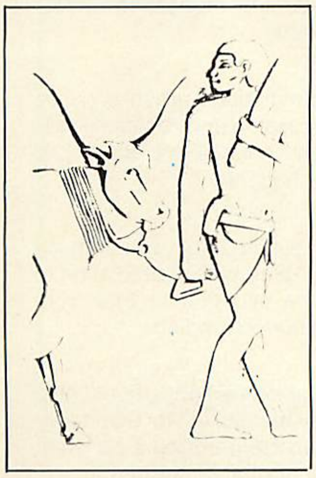
Having found a possible site, the children begin their excavation. Each tomb contains a series of passages, chambers and shafts closely modelled on those at Saqqara. As with the surface survey the children must carefully plot their excavation. They must decide on the number of workers to employ to do the digging through the 'sand-filled passages' or 'stone' to enter the tomb. Where they dig and what strategy they adopt must all be recorded or they could find themselves having to dig further tunnels, at extra cost, to re-enter the tomb.

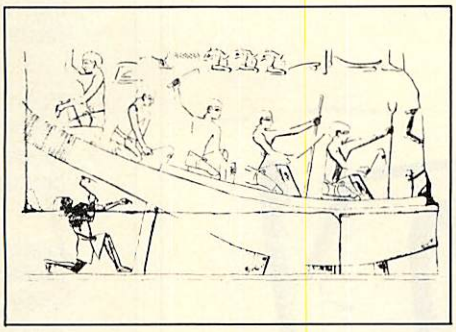
When they are successful in making a find of archaeological significance a message such as 'Archaeological Find 48D' is displayed. The teacher then gives the children a picture and/or details of their discovery. It is at this point that the children search through the reference books for further information and try to attach appropriate significance to their find. One of the major values of this type of historical simu-

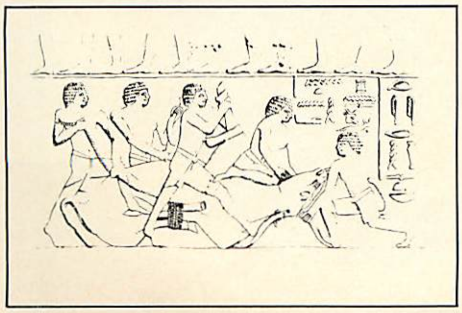


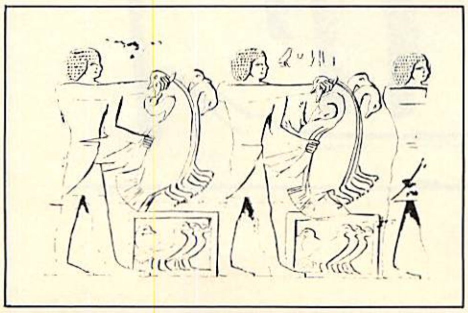












Game cards from the Saqqara pack, illustrating the archaeological discoveries that the pupils make

lation is shown at this point. The children are looking for a specific reference, developing a mosaic of historical facts linking each new find to their previously acquired knowledge. As the children discover new facts, they reorganise their thinking because of the new information, which serves to demonstrate that historical knowledge is not finite but is being added to daily.

At the end of their session, each group is given a summary of its finances and is informed of any disasters which have befallen it. These are varied and can include 'the Land-Rover breaking down' or 'offending the workers,' for which extra costs are incurred.

It must be stressed that the bulk of the work is done by the children away from the computer. Also, the learning is not derived from merely responding to the computer's display but is in the interaction of the group, the research and the joy of discovery. This is exemplified by the experience of one teacher who took his class to an Egyptology exhibition at the British Museum after running the program. While walking through one of the galleries a child suddenly exclaimed: "We found that!" It was a stone baboon from the site at Saqqara and had featured in the program. His excitement was real.

There is a series of simulations which are designed to encourage children to work co-operatively. Projects like the *Mary Rose*, which simulates the discovery and excavation of this now famous Tudor warship (see review in the February issue), are designed to give children the chance to speculate, to become involved as far as possible, in the reasoning processes used by the 'real life' experts.

Another simulation, *Round the World*, provides practice in reading simplified timetables, use of the 24-hour system, and addition and subtraction of time. As the title suggests, the children have to journey to several countries in the world, starting from London. They must decide from a clue their next destination, how they will travel (using the permitted options), and calculate the length of the journey to their next destination. This may be part of a geography project in which the children produce a folder on the countries they visit during their travels. The groups devise a number of approaches to solve the problems. In some they work independently, coming together only to check their results, while others may work together.

One group that had to travel from Tunis to Tashkent, asked if they could go by train to Cairo, from Cairo to Delhi by plane and then drive to Tashkent. Asked why they wanted to take that rather circuitous route they replied: 'We can save 12 hours on the ferry and train option!' Unfortunately the computer program did not allow this combination, but as it already contains 20,000 pieces of information there is a limit to just how 'real' a simulation can be. I did, however, promise to take 12 hours off their total journey time if they recorded the details and could prove them correct. They did.

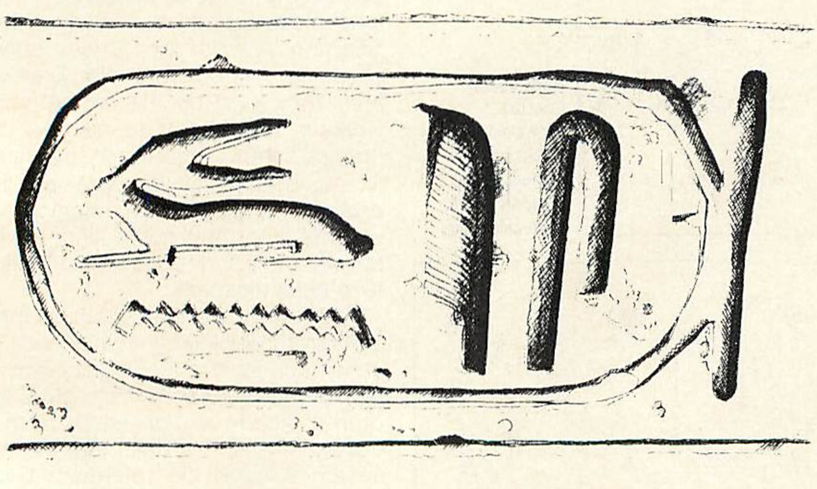
The examples used here to illustrate the idea of computer simulations with children serve to show the motivation and enthusiasm which can be generated. They give opportunities for groups of children to work together to solve a common problem. The contributions made by individuals in helping the group to succeed will vary during the course of the project. Children may lead, offer suggestions, or be purely supportive to ideas they consider of value. It is within the group that there will be this interplay and exchange of ideas which is one of the fundamental aims of these simulations. If education is to be concerned with helping and improving the quality of children's thinking, it is essential that they are given opportunities to undertake exercises with this as a basic aim.

The potential for enhancing primary education is there. The work produced by children is evidence of the enthusiasm, the discussion evidence of the involvement. All it needs is for teachers to accept the challenges the computer brings. ●

Barry Holmes and Steve Fletcher teach at St Helens CP School, Bluntisham, Cambs. Mary Rose (£32.50 + VAT, for BBC model B), Expedition to Saqqara (£32.50 + VAT, BBC model B), Round the World (£28 + VAT, BBC model B), Adventure Island (£32.50 + VAT, BBC model B), from Ginn, Prebendal House, Parson's Fee, Aylesbury, Bucks HP20 2QZ.

Acorn User's consultant for the schools series is Paul McGee, of the Microelectronics Centre, Croydon.

The children have to research the significance of their find



POINTS TO REMEMBER

1. Simulations can be just as effective in the primary classroom as in higher education.
2. Simulations allow pupils to follow the steps of historical figures or the reasoning processes of real life aspects.
3. Good simulations provoke pupils into discussion and decision-making: poor ones leave them just pushing buttons.
4. Young pupils often need much 'playing' time with a simulation to relate the situation to their conceptual understanding.
5. Historical simulations should help develop the ability to use references and to produce a coherent account of what happened.

HEAVEN'S DATE

Paul Caswell's challenge was to computerise the formula by which Easter Sunday was fixed. He reached for his prayer book . . .

IT ALL started with a straightforward program to print the Gregorian calendar for any month of any year. 'When's Easter, then?' asked a voice. And so I set off on an analysis of the tables in the Book of Common Prayer that left me with extreme regard for the ancients and the beautiful simplicity of the system they devised.

Easter Sunday, you recall, is the first Sunday after the date of the Paschal Full Moon after the vernal equinox: when the sun returns to the northern hemisphere for our summer. So the first problem is to see how the date of this Paschal Full Moon is decided within the prayer book.

Using modern figures, the length of the (mean solar) year is 365 days 5 hours 48 minutes and 46 seconds; and of the (mean lunar) month 29 days 12 hours 44 minutes and 2.87 seconds. Hence:

19 years = 6939.601782 days
235 months = 6939.688362 days

In other words, the date of the Full Moon repeats in a 19-year cycle with an error of 0.08658 days (about 2 hours). Furthermore, each year equals 13 months *less* 18.65 days: the moon advances 18.65 days each year.

The first step is to construct a simple form of this 19-year cycle. To the nearest integer, each month will have 30 days and the advance from one year to the next will be 19 days – yes, 19 again! This the prayer book does, but there are two snags to be overcome:

1. A span of 30 dates would include two Full Moons, so only 29 dates are available to allocate to the 30 days of the cycle: this is overcome by counting either April 17 or April 18 twice.
2. Since 19*19 MOD 30 = 1 rather than 0, the advance from the end of one cycle to the start of the next has to be 18 days rather than 19. This makes it essential that our program starts each cycle on the same year as the prayer book.

Now we need a way of numbering off the years within each 19-year cycle. This is done by calculating the 'Golden Number' by the formula n = (year + 1) MOD 19, except that if this is 0 it is called 19.

So far so good. But remember that error of about 2 hours in each cycle? After 341.08 cycles this aggregates to a whole month. So there is another 'outer' cycle correcting the first simple 19-year effort. In fact, the prayer book gets stuck on the number 19 and uses 19*19 cycles, simplified to 69 centuries, for the period of this outer cycle.

If we ignore the year 1600AD, when the table started off anyway, the cycle will contain 17 leap-centuries. So instead of cycling through our 30-day month as 0-29, we have to cycle 0 to (29 + 17 = 46) and then knock off a number each time we cross a leap-century. This done, the pattern used in the prayer book is beautifully simple (see figure 1).

You can see that the pattern is almost achieved by a simple +1 +0 +1 +1 +0 +1 system, except that it is necessary to insert an extra 1 after 25 and after 50 centuries to achieve the desired cycle.

It is clear from the prayer book tables that the compilers did not realise that for the calendar to keep step with the sun, the years 4000 and 8000 will have to be non-leap. It is unfortunately difficult to persuade the authorities of Church or State to address this decision with the urgency required of our poor little computer! But this difficulty aside, it is now easy to construct a computer program to add the date of Easter Sunday to our calendar. ●

Figure 1.

Years	Pattern	Leap correction	Prayer book
1600	0 1 1 2	−0	0 1 1 2
2000	3 3 4 5	−1	2 2 3 4
2400	5 6 7 7	−2	3 4 5 5
2800	8 9 9 10	−3	5 6 6 7
. . .			
4000	16 17* 18 18	−6	10 11 12 12
. . .			
6400	32 33 34* 35	−12	20 21 22 23
. . .			
8000	43 44 45 45	−16	27 28 29 29
8400	46 0	−17	29 0

PASCHAL FULL MOON

The moon is not entirely regular in its habits, so may come around as much as two days before or after its 'mean time'. (The sun is also irregular: hence Greenwich mean time). In the interests of simplicity, this and other small discrepancies are accepted and the date of Easter calculated by reference to a 'theoretical' moon defined by the tables and called the Paschal (ie, Church) Full Moon.

JULIAN CALENDAR (Known as 'Old Style')

Established by Julius Caesar as from January 1, 45BC, this had 365 days in a 'common' year and 366 in a 'leap' year. One year in every four was to be a leap year and so the average year has 365.25 days. This is about 11 minutes too long, so after a while the seasons got out of step with the calendar dates – hence the need for a reform.

GREGORIAN CALENDAR (Known as 'New Style')

Pope Gregory XIII directed in 1582 that century years should not be 'leap' unless divisible by 400. Thus 1900 was not 'leap' but 2000, the last year of this century, will be. This 'New Style' calendar, which almost corrects the Julian error, was adopted in Great Britain by Act of Parliament in September 1752, but in some countries not until this century, and in some Eastern churches not yet! On adoption of this calendar, the one we use today, the dates were corrected for the discrepancy accumulated by the Julian error since the Council of Nicea in AD325, when the rules for Easter were decided.

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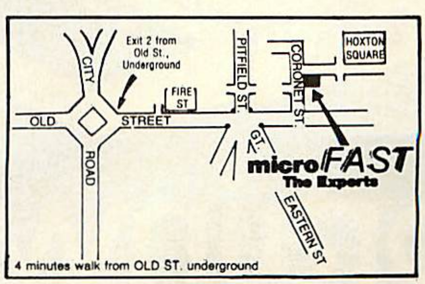
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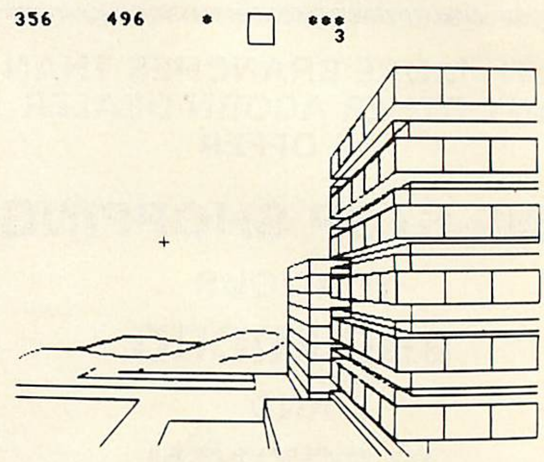
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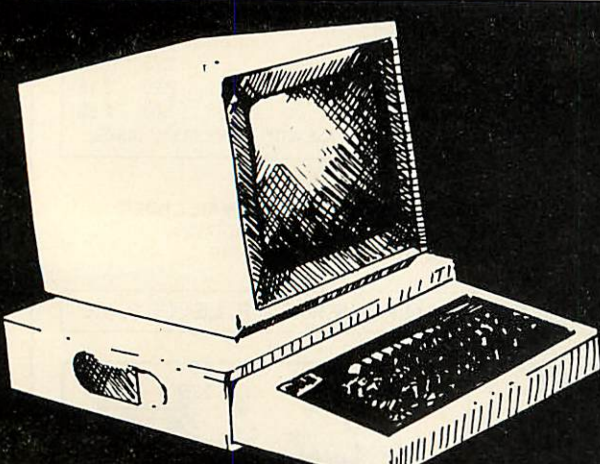
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BRUSH UP ON YOUR WRITING

Input and output are vital to many programs, but need thinking about. Susan Jones gives her ideas on improving your programming

THE BBC micro owner is now faced with a plethora of software, but much of it fails to exploit the capabilities of the machine to the full. This article focuses on techniques for producing clear, professional-looking output and providing concise, flexible and secure input facilities. These are illustrated with general-purpose procedures, which assume some familiarity with the *User Guide*, but do not require acquaintance with esoteric ideas such as indirection operators.

Perhaps the first point to discuss is whether software writers should exploit machine-dependent features at all. Portability – the ability to run programs on different machines – is a valuable objective, and a great deal of effort is wasted in converting or rewriting programs originally conceived for a different machine. However, we must be realistic: Basic is a language notorious for its dialects and any attempt to work with a 'standard' subset would mean relinquishing just those features of microprocessor systems which make them attractive, namely the graphics, screen-formatting and special input facilities. Moreover some of the extensions to the language provided on the BBC machine, such as repeat loops and parameterised procedures, allow us to write more concise and powerful programs. So the use of machine-dependent language features may be justified on the grounds that:

- the BBC machine is attracting a large community of 'customers' for specially-written software;
- although extensive rewriting of the *code* of a BBC Basic program will be necessary to transfer it elsewhere, the logical structure should be so much clearer that the conceptual difficulties of rewriting for another Basic machine (or another language) are actually eased.

A common requirement in educational software and games instructions is to print small sections of text which the user can take in at his own speed, moving on when ready. First, how to output text? The obvious answer seems to be by a series of commands to PRINT quoted character strings. However, this sort of text is essentially program *data*, and so the business of printing it might be best isolated in a self-contained procedure like this:

```
DEFPROCpage: LOCAL N%, I%, Line$
READ N%: FOR I% = 1 TO N%: READ Line$
PRINT Line$: NEXT I%: ENDPROC
```

Every page is treated as a separate block of data, preceded by a count of the number of lines to go on to the screen, for example:

```
DATA 4, "This is a program about..." , "In a minute you will see..." ,"","Look carefully and decide..."
```

Four lines, one of them blank. Data lines like these can be planned, typed and edited independently of the program to print them. Note that the procedure contains local declarations for variables N%, I% and Line$; the use of these variables here will not affect their value elsewhere, so PROCpage can safely be called from any other part of the program. It can be used with:

```
DEFPROCreturn: PRINT ' ' ' "Return"
*FX 15,0
REPEAT: UNTIL GET = 13: CLS: ENDPROC
```

PROCreturn spaces down three lines from the current print position, and prints "Return" to indicate that the user must press the return key to move on. The *FX command clears the keyboard buffer. The repeat command sets up a loop to read and test any keystroke; since 'return' is a non-printing key, it is the corresponding ASCII code (13) which is tested for. Before exiting, the procedure clears the screen, or at least that part of it defined as the text 'window'. In the main program, pages of text can be output simply by making a series of procedure calls, eg, PROCpage: PROCreturn: PROCpage, etc. If the sequence is sufficiently repetitive these calls can themselves be put into a loop.

Where text and graphics are to be displayed simultaneously it is often wise to define two separate windows which can be cleared and scrolled independently. The following example assumes a division of the screen into a top and bottom half, in mode 4 or mode 1. The relevant commands would be:

```
VDU 24, 0; 512; 1279; 1023;
REM graphics window at the top
VDU 28, 0, 31, 39, 16
REM text window at the bottom
```

Details of these VDU statements are given in the *User Guide*; here simply note that both specify left, bottom, right and top limits, the first in terms of graphics 'points', the second in terms of lines and character positions (note the use of ';' in VDU 24).

```
DEFPROCreplace(CH1$,CH2$,X,Y)
VDU 5: REM go into 'graphics-directed' mode
MOVE X-16, Y+16: GCOL Ø,Ø: PRINT CH1$;
REM erase by over-printing in background colour
MOVE X-16, Y+16: GCOL Ø,1: PRINT CH2$;
REM print in foreground colour
VDU 4: REM return to 'text-directed' mode
ENDPROC
```

Listing 1. Erasing characters in graphics modes must be numbered and called (*User Guide*, page 102)

CLS will clear text and CLG will clear graphics. Overlapping windows can be defined, but they may interfere with one another.

Text can be written in the graphics window, but its position and colour is determined by graphics-based rather than text-based commands. For instance, characters can be erased only by, as it were, replotting them in the background colour. The procedure in listing 1 wipes out CH1$ centred at postion X,Y and replaces it by CH2$.

By default it is the top left corner of the character which appears at the current X,Y position: hence the use of X−16, Y+16 to 'centre' the character correctly.

Next, consider sound output – an area where the BBC machine has sophisticated facilities. We will deal only with its simplest functional use; to give warnings when expected input is not forthcoming or incorrect. This is too often overdone; loud, prolonged or shrill 'beeping' of users' mistakes is in the end counter-productive. I find even the default noise produced by VDU 7 unacceptable, and prefer the procedure:

```
DEFPROCbuzz(V%): SOUND 1,V%,50,1:
  ENDPROC
```

Volume setting, given here by parameter V%, is best adjusted according to the noise level of the room in which the program will be used.

It should go without saying that no incorrect data supplied by the user should cause a program error. In BBC Basic, non-numeric data typed in response to a request to INPUT a numeric value will be treated as zero, for which a check can be made. The procedure in listing 2 accepts three parameters: a message to be printed, and upper and lower bounds for the range of acceptable input values. It exits only when it has received a number within range, otherwise it buzzes and returns the cursor to a point on the screen immediately following the message.

```
DEFPROCnumin(Mess$,High,Low): LOCAL OK
REPEAT: PRINT Mess$;: INPUT Num
OK = Num <= High AND Num >= Low
IF NOT OK THEN PROCbuzz(V%)
UNTIL OK: ENDPROC
```

Listing 2. Checks numeric values

OK is used in listing 2 as a *logical* variable, saving the result (true or false) as to whether Num is in range or not. The trouble with this procedure is that although values for Mess$, High and Low can be sent to it as parameters, it is impossible to transmit the value of Num back to the calling program in the same way (although utilities printed in *Acorn User* have helped do this). An assignment made to a parameter with a procedure has no effect outside it. So Num must be a *global* variable, seriously detracting from the generality of the procedure. Perhaps the solution is to recast it as a function, which is allowed to return at least one value to the calling program:

```
DEFFNnumin(Mess$,High,Low): etc.
as before
UNTIL OK
=Num
```

This function can now be called in quite a general way:

```
P = FNnumin("How many players",1,4)
Q = FNnumin("How many questions",5,10)
```

For a more flexible, but slightly riskier, form of numeric input, the special EVAL function can be used to evaluate *expressions* typed in by the user. For example:

```
PRINT Mess$;: INPUT Expr$: Num =
  EVAL(Expr$)
```

It may be convenient to allow the user to input 1/3, say, instead of .33; unfortunately the input of an erroneous non-numeric character may cause program failure because EVAL is looking for a non-existent variable. Such an error can be trapped by the ON ERROR statement, but this in itself may have unwanted side-effects, so caution is necessary.

There are a number of possible approaches to non-numeric input and validation, and complete generality is difficult to achieve. If a user is required to input one of, say, a dozen character strings, it is almost always necessary to:

- check the string is valid;
- link it to a number which will be used to select the appropriate part of the program to execute (this is called 'mapping').

There are several alternatives, including menu selection, full-word input and single character input.

With menus, the program lists numbered possibilities and a selection is made by typing the appropriate number. Essentially it is the user who does the 'mapping', and validity checking is reduced to a range check similar to the one discussed above.

In cases where it is more natural for the user to type in real words, or names, checking and mapping is best done by scanning an array of valid words. Not only is this method more concise in terms of code than using a series of individual IF statements, it makes it easy to extend the range of possibilities. Nothing betrays the amateur programmer like a failure to exploit arrays for this sort of problem. Listing 3 gives a procedure to search an array of length N% for a valid word, repeating the question until it gets one! On exit the global variable W% holds the appropriate index.

Unfortunately, it is impossible to generalise this procedure without resorting to the use of indirection operators. Arrays in BBC Basic cannot be parameters, so the procedure is limited to searching Table$, which must have been dimensioned and initialised in the main program:

```
DIM Table$ (N%): FOR I% = 1 TO N%
READ Table$(I%): NEXT I%
DATA BACK, FORWARD, LEFT, RIGHT,
etc., ""
```

Note that for PROCwordin to work properly N% must be one greater than the number of possible words and the last entry in Table$ must be a dummy. Those familiar with more orthodox Basic may wonder why the inner loop of the procedure was not written using the FOR ... NEXT construction. A search implies a premature exit from the loop when a match is found and unfortunately this is not advisable in BBC Basic; it leaves 'loose ends' on the system stack which may cause overflow and program failure.

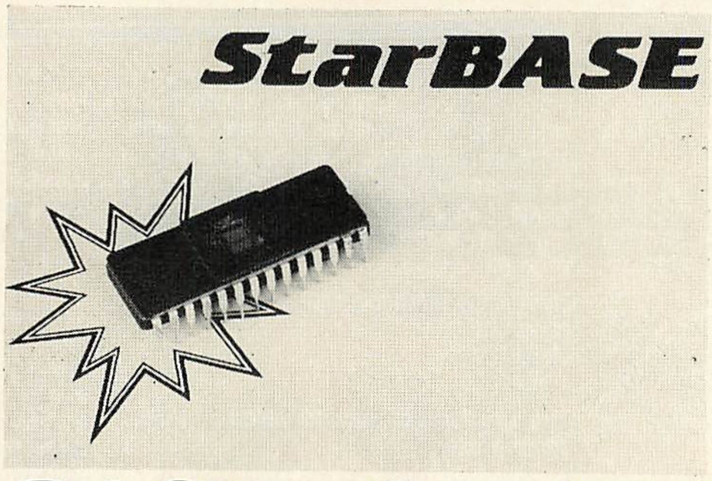
```
DEFPROCwordin(Mess$,N%): LOCAL Word$
REPEAT: PRINT Mess$;: INPUT Word$: W% = 0
        REPEAT: W% = W% + 1
        UNTIL W% = Table$(W%) OR W% = N%
UNTIL W% < N%: ENDPROC
```

Listing 3. Searches array for valid word

If the range of possible inputs can be confined to single characters (by, for instance, arranging that initial letters shall be unique), the GET$ function can be exploited. Listing 4 is a simple procedure to accept two possible answers, 'Y' for yes and 'N' for no.

One advantage of single-character input is that only correct answers have any effect, since data input via GET$ is not

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automatically displayed on the screen. There is no need to buzz, or repeat the question; the fact that an answer is ignored indicates it is wrong. This could be valuable in educational software, forcing the user to concentrate on the task in hand rather than indulge in irrelevant dialogue.

Where there is a greater range of possibilities than two, the character can be looked up in a string of valid possibilities using INSTR. Alternatively, conversion to numeric form can be made via ASCII. It is a good idea to provide the same mapping for upper and lower case versions of the same letter. This function converts A-Z, a-z to 1-26:

```
DEFFNconv(CH$) = (ASC(CH$) - 64)
  MOD 32
```

Non-alphabetic characters can be detected by a range check; more complex mapping can be made via an intermediate array, using converted ASCII characters as subscript.

With single character input, it is advisable to turn off the auto-repeat on the keys, otherwise users who are inclined to 'lean' on a key may receive output too fast to read. *FX 11,0 turns off auto repeat. *FX 12,0 turns it on again, and this should always be done before leaving the program so editing works as normal.

Even without auto-repeat, the user may inadvertently build up a 'queue' of input characters by idly tapping the keys while the program is busy, only to have a series of outputs flashing past when it is ready to accept input again. To avoid this, use *FX 15,0 at strategic points in the program to flush the input buffer (this instruction occurred at the beginning of PROCreturn, given above). *FX commands must always be put on to a separate program line.

It is often necessary to be able to move a dot or line around the screen to draw or 'point' at something. The gray arrow keys seem obvious for this purpose, although their positioning is not ideal. Normally, they are ignored by the GET and INPUT functions, but the ability to read in the appropriate ASCII codes when they are pressed can be turned on by *FX 4,1.

It is more useful, however, to sample the current state of the keyboard directly, to detect whether two or more keys are being depressed simultaneously, allowing the user to move diagonally. The technique is to use INKEY with the appropriate negative argument, as specified on page 275 of the *User Guide*. This returns 'true' or 'false' according to whether a particular key is being pressed, and we can exploit the fact that in BBC Basic 'true' is represented as −1 and 'false' as zero. The procedure in listing 5 (used in modes 5 4, 2, 1 or 0) draws lines on the screen under the direction of the arrow keys, starting at position X,Y.

In detail, consider what happens on the X axis in this procedure. If neither horizontal arrow key is depressed, both INKEY(−26) and INKEY(−122) return zero and X remains unchanged. Otherwise it is incremented by −1 (+ INKEY(−26)) or +1 (−INKEY(−122)) according to whether the left or right arrow is pressed. The same principle applies on the Y axis.

The procedure works correctly until either co-ordinate goes outside the limits of the screen. This can be prevented by changing the assignment statement to:

```
X = ABS((X+INKEY(-26)-INKEY
  (-122))MOD 1280)
```

MOD 1280 will convert from 1280 to zero and the ABS function will convert from −1 to +1. Thus we get 'wraparound' on the right edge, 'bouncing off' the left edge. Once again the Y co-ordinate can be treated in a similiar way. To move rather than draw, wipe out the dot at the current position before printing a new one. Because this technique is based on sampling directly the current state of the keyboard, it is unaffected by settings of *FX 11, 12, and 15, which are related to the input buffer and queue.

A good general-purpose piece of software should allow a choice of options according to the environment in which it will be used. Obvious examples are: black and white or colour monitor, volume setting for music and sound effects. It is annoying not to be able to alter the volume of sound output from a program; most people confronted by the machine for the first time automatically look for a volume control!

Ideally these options should have built-in defaults; should be selectable before the program begins running, and should remain in force for as long as the machine is turned on. Use of the BBC Basic 'resident integer variables' A% to Z% as program switches satisfies these requirements. They are already defined when the machine is turned on but can be reset in immediate mode and retain *their* values between successive program executions (although their values vary between operating systems). In the following sequence of instructions colour and sound switches (as used earlier) are set *before* loading a program:

```
C% = FALSE
V% = -9
CHAIN "LESSON1"
```

A program using this technique should begin by setting any switch out of its available range to a default value. For example:

```
IF V%>0 OR V%<-15 THEN V% = -5
```

Obviously the use of switches can add flexibility to an educational program, but it should not be the lazy programmer's excuse to avoid writing dialogue.

Of the examples presented above, it could be claimed that any resemblance to standard Basic is purely coincidental! But one practical advantage of the constructions used is that they do not refer to line numbers, and are as general as language allows. It is possible to hold a set of such procedures (with line numbers) on tape or disc, and merge them with any program that requires them (as Joe Telford has been doing over the past year in his articles). The Basic user now has something like a subroutine library facility – a convenience enjoyed by programmers in other languages for many years. Some limitations on the generality of BBC Basic procedures have already been pointd out, however; in particular that it is difficult to use array parameters or to return values to the calling program through the parameter list.

In general, however, the programming environment which the BBC machine provides is favourable. While retaining the immediacy, simplicity and unfussiness for which Basic has always been popular it is designed to encourage inexperienced users to construct their programs in a logical way. At the same time, it makes it possible for professional programmers to exploit the hardware to the full and create some very sophisticated software. ●

Listing 5. Draws a line controlled by arrow keys

```
DEFPROCdraw(X,Y): REPEAT
X=X+INKEY(-26)-INKEY(-122)
Y=Y+INKEY(-58)-INKEY(-42)
PLOT 69,X,Y: UNTIL ......
ENDPROC
```

```
DEFPROCanswer: LOCAL A$
REPEAT: A$ = GET$: UNTIL A$ = 'Y' OR A$ = 'N'
IF A$ = 'Y' THEN PRINT 'YES' ELSE PRINT 'NO'
ENDPROC
```

Listing 4. Checks for 'yes' and 'no'

YOU CAN TRY IT NOW!

Rest the fingers of your right hand on a table top. Imagine the keys.

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DFS 0.90	Acorn
View A1.4	Acornsoft
Wordwise 1.17	Computer Concepts
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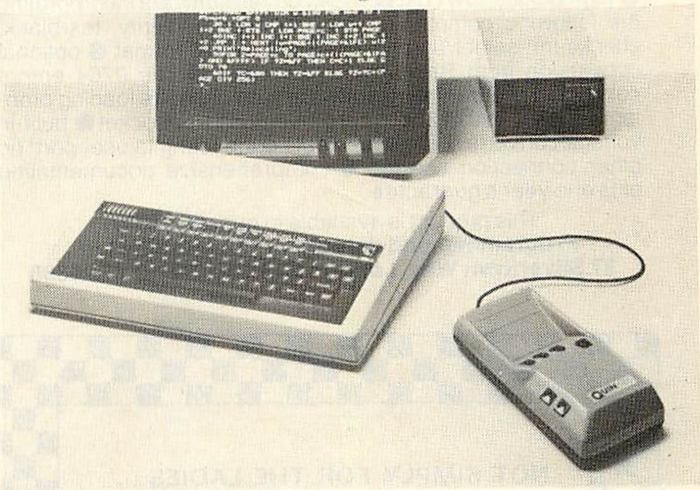
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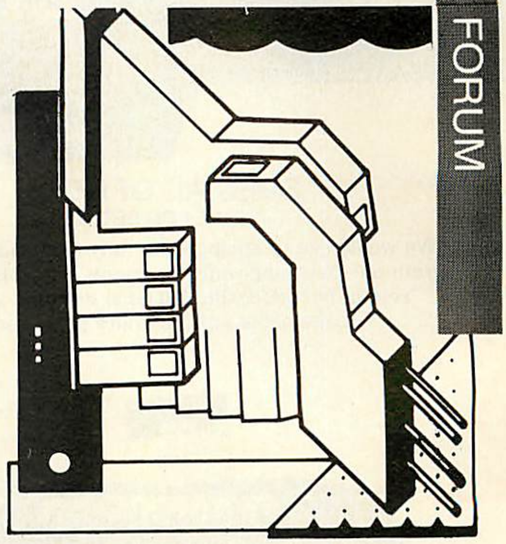
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FLASHING TEXT ROUTINE

WE HAVE previously covered the flashing cursor as a means of prompting for input. The Beeb, in teletext mode, can also flash lines of text, and listing 1 provides the Atom with a similar function.

The routine, once assembled, is enabled by LINK #2800 (or wherever you assemble it to) and uses variables R, C and N to specify, respectively, the start Row (1 to 16), start Column (1 to 32) and Number of succeeding characters to be flashed (1 to 127). Once linked, the routine will flash the specified text until a key is pressed.

The parameters are stored in zero-page locations #90 to #95, and lines 20-60 initialise this block. Line 40 gets the current value of R, line 50 the value of C, and line 60 sets the flash rate (here 14/30ths second). Lines 70 and 80 get the value of N and subtract C to get the final column value. Lines 100-150 calculate the absolute address of the row, and lines 160-190 calculate the column offset, thus setting up a vector in #90,91 to the start of the text to be flashed. Lines 200-240 use this vector to store temporarily the old text from #2880 onwards (which is why N must not be larger than 127, or it will overwrite any program at #2900), then wait. Lines 250 and 260 now replace the screen text with spaces. Line 270 checks for a keypress, exiting if found; otherwise, after another delay (line 280), lines 290-320 restore the old text. A further keypress check is made (line 330) before the whole thing repeats itself.

If you want the keypress to be stored for checking, add the following line, which will store it in #96: 335 STY#96

```
  5REM: Flash Text
  7REM:R=ROW;C=COL
  8REM:N=NO.OF CHARS
 10P=#2800;[
 20 LDA@#80;STA#91
 30 LDA@0;STA#90
 40 LDA#333;STA#92
 50 LDA#324;STA#93
 60 LDA@14 ;STA#95
 70 LDA#32F;CLC
 80 SBC#93;STA#94
 90 INC#94;INC#94
100 LDX#92
110 DEX;BEQ P+16
120 LDA#90;CLC
130 ADC@32;STA#90
140 BCC P+4;INC#91
150 JMP P-14
160 LDY#93;DEY
170 TYA;CLC
180 ADC#90;STA#90
190 LDY@0
200 LDA(#90),Y
210 STA#2880,Y;INY
220 CPY#94;BNE P-8
230 LDX#95;JSR#FB83
240 LDY@0
250 LDA@32;STA(#90),Y
260 INY;CPY#94;BNE P-7
270 JSR#FE71;BCC P+24
280 LDX#95;JSR#FB83
290 LDY@0
300 LDA#2880,Y
310 STA(#90),Y;INY
320 CPY#94;BNE P-8
330 JSR#FE71;BCS P-41
340 RTS;];END
```

Listing 1. Text flasher

POPPING OUT

JUMPING out of loops is not a practice I recommend. It's sloppy programming and can lead to all sorts of problems. However, when converting programs from other machines (like the TRS-80), it's sometimes necessary. Locations 13, 14 and 15 (hex) in page 0 hold a counter which contains, respectively, the current depth of nesting for DO . . . UNTIL, GOSUB . . . RETURN and FOR . . . NEXT loops. Setting these locations to zero will allow you to jump out of such loops. Don't try to use this to increase the depth of nesting – it won't work.

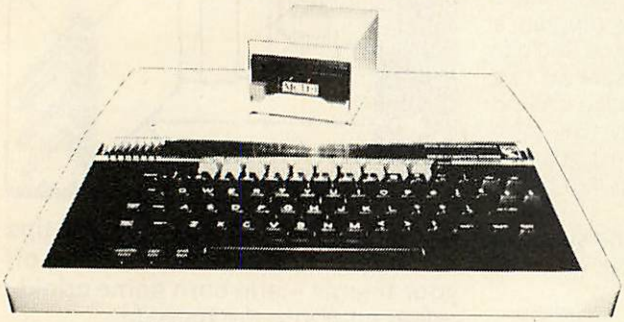
With FOR . . . NEXT loops another solution is possible. This is to enclose the loop that you wish to jump out of within another loop that will never be jumped out of. When you jump from the inner loop, the program will eventually come across the NEXT of the dummy loop then, as it increments the counter, it resets the data left by the inner loop, avoiding an overflow.

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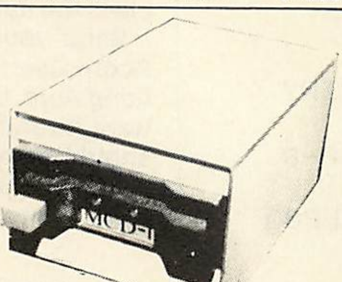
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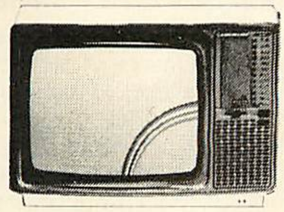
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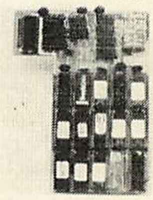


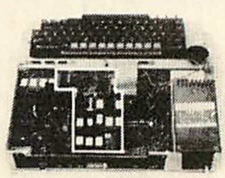
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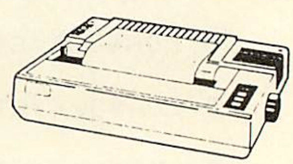
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STRETCHING THE LINE-LENGTH

THE Atom's maximum line-length of 64 characters is limited by the length of the input buffer at #100. The input routine, located at #CD0F, uses #52 to check the number of characters input by setting it to zero and subtracting it from the Y register, which is incremented as each character is input. If the result is 64, a routine at #CD4A sets up a loop which can be exited only by pressing the delete key.

Listing 2 allows you to enter program lines of up to 224 characters and has an added bonus in that, although any Atom will execute such long lines, they cannot be edited properly unless this routine is present – so you get program protection as well! LINK #3CA to enable.

Lines 20 and 30 set up the RDCHVEC to point to this routine. Line 60 saves time by checking whether you have input more than 63 characters. If not, it reverts to the normal routines. Line 70 checks the Y register for the new line-length and exits if reached, causing the routine at #CD4A to be called. Line 80 checks the ESC key and line 90 checks for CTRL-X (CAN), resetting #52 to zero if so. Line 110 is the trick. It increments #52 with each character entered, so that the subtraction process always produces a result of 63, thus fooling the computer into thinking that there is always one more space free in the input buffer.

Finally, a word of warning. This routine will also allow you to enter long strings during a program. Don't try it, since it will overwrite the processor stack!

```
5REM: Long Lines
10P=#3CA;Q=P+13;[
20 LDA@(Q%256);STA#20A
30 LDA@(Q/256);STA#20B
40 JMP(#208)
50 JSR#FE94
60 CPY@63;BCC P+20
70 CPY@224;BCS P+16
80 CMP@127;BEQ P+12
90 CMP@24; BNE P+6
100 LDY@255;STY#52
110 INC#52;RTS;]
120END
```

Listing 2. The 64-character question

DISCO FEVER

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HERE'S something completely different. Listing 3 monitors the cassette port and displays the pitch of whatever it finds as a continuous graph. Thus, if your tape player's output socket does not disable the speaker, you get something to watch, as well as listen to. Try experimenting with the step value in line 20, for different effects. It's extremely effective on disco music, which has a pronounced beat, and I've had hours of fun playing with it! Tim Pierse, the author, earns £20 and asks readers to submit any other routines, especially for disco effects. I'll start the ball rolling with listing 4, a multicoloured lightshow. Pressing Shift causes the colour palette to change (it sometimes does this at random, as well) and REPT clears the screen for a new display. Passages of silence cause the screen to gradually white out. Have fun!

Listing 3.

```
5REM: Oscilloscope
10 CLEAR4;MOVE 0,0
20 F.X=0TO255 S.5
30 Y=0;F.N=1TO10
40 Y=Y+?#B002&#20
50 N.;Y=(Y/3)+10
60 DRAW X,Y
70 N.;RUN
```

Listing 4

```
5REM: LIGHTSHOW
10 CLEAR0;T=#8000;GOS.b
15 B=#8100;P=#B002
20 DO Y=0;X=A.R.%256
25 A=256-X;F.N=1TO10
30 Y=Y+?P&#20;N.
35 Y=(Y/3)+10
40 IFY>100;?P=?P:8
45 G.(50+(Y%3*5))
50 C=#FF;G.a
55 C=#A0;G.a
60 C=#40;G.a
65 C=C&#FF
70a X?T=C;A?T=C
75 X?B=C;A?B=C
78 IFP?-1&#80=0;?P=?P:8
80 U.?P&#40=0;RUN
85bF.N=T TO(T+512) S.4
90 !N=-1;N.;R.
```

MEMORY BANK

WHEN I reviewed the BBC Basic conversion card last year (February and March 1983 issues) I casually mentioned the three 'spare' address lines at IC6. Some of you, apparently, don't know about this so here goes.

Pins 7, 14 and 15 carry addressing for RAM at, respectively, #3C00, #2400 and #2000. RAM chips can be 'piggybacked', as described in the February 1983 *Acorn User*, onto ICs 10-13 (#2000 to #27FF) and ICs 18-19 (#3C00 to #3FFF), to provide a continuous 8k bank. The lines from pin 8 of each 1k pair should be taken to the appropriate pins of IC6. If IC5 is present, these lines should also be ANDed to pin 1 of that IC. Be careful with your soldering since the machine will 'hang up' and some RAM could be damaged if the lines ever become disconnected. After adding the chips, test the new RAM as described in section 12 of the manual.

If you have the BBC card or the Acorn disc pack, don't bother adding RAM for #2000 to #27FF – it's already there!

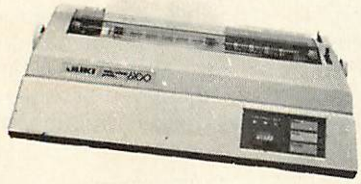
TRIPLE SPACING

HERE'S a quick tip for Wordpack users. You will all know that setting #FE to 255 overrides the linefeed inhibit so that on printers with auto-linefeed you get double-line spacing in normal use. What I've only now realised (I've just done it by accident!) is that with double spacing selected in Wordpack this causes triple linefeeds. Must be of use to someone!

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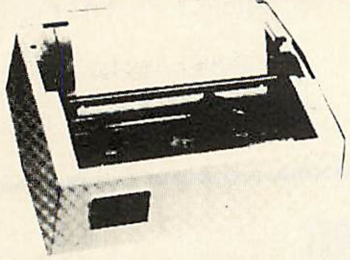
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ATOM ROM ROUTINES

by Mark Plumbley

THIS is a disassembled listing of virtually *all* the routines in Atom Basic and the cassette operating systems.

Here are a few general notes of explanation.

In the Basic and assembler routines, anything which appears in angle brackets, < >, is a syntactic entity, in the same format as in Chapter 26 of *Atomic Theory and Practice*. Anything inside double quotes ("..") has already been recognised, before calling this routine.

All integer arithmetic is done using a 15-deep accumulator stack, in page 0 at #16+X,#24+X,#34+X,#43+X. Page zero location #04 contains the pointer to the next available accumulator, and most of the routines load this into the X register themselves. For example, before routine #C97A is called, a <term> has already been recognised and evaluated, and its value left on the accumulator stack. Also, a + sign has been found. This routine will then evaluate another <term>, add it to the other, and then return, leaving the result on the top of the accumulator stack.

The text pointer is held in locations #05,#06+Y , where Y is held in location #03. Most routines will load location #03 into Y themselves, but a few, like #C4F6 or #C90A, expect this to be in the Y register already.

To keep the information to a manageable level, the complete entry and exit conditions for all the routines have not been specified, but it should not be too difficult to use them, after a little disassembling. Also, the FP ROM or DOS routines are not included. All numbers are in hexadecimal.

```
        BASIC
C000 Tables for decode symbol routines
C22C Get <factor> into location 0F, then ...
C231 Skip comma if necessary
C233 Decode keyword/symbol
C279 Test for '=', error if not
C27B Decode single byte symbol
C2AD "NEW"
C2B2 Start up basic, then ...
C2CF Enter immediate mode
C31B <statement>!"THEN"<statement>
C325 "LET"
C334 "PRINT"
C3B2 "LINK"<factor>
C3C8 Push <factor>, then ...
C3CB Set Y=@#52, then ...
C3CD Pop number from acc stack into 00,Y .. 03,Y
C3E5 "<variable> ="<expression>
C3EE "!"<factor>=<expression>
C406 "?"<factor>=<expression>
C40F "*" (send rest of line to OSCLI)
C424 Check if FP ROM exists, C set if it does
C434 Get <variable> number (@=0,A=1 etc.),
     C clear if no variable
C465 If next symbol is a <variable>, then
     error, else ...
C46A Get <positive number>, C clear if
     no number
C4DE Test for '=', then ...
C4E1 Get <expression>, then ...
C4E4 Test for <statement delimiter>, then ...
C4F6 Re-point text pointer, then ...
C504 Test ESC key, go to immed mode if pressed,
     return if not
C50C Set up text pointer to following statement
C550 Handle unrecognised <statement>
C55B Go on to next statement
C566 "IF"<testable expression>
C575 "REM"
C589 Print acc no 0 in decimal
C5C8 Print hex single digits from #45,X to #45
C608 Constants for 'print decimal number' (C589)
C62E Find BASIC line given num on stack; pointer
     left in 58,59, C set if found
C661 Set up misc workspace ready for * or /
C689 Do division in misc workspace
C6DA Get <expression>, then ...
C6DD Perform relational tests
C70C <testable expression>
C714 "<relnl expression> AND"<relnl expression>
C722 "<relnl expression> OR"<relnl expression>
C72C <relnl expression>
C731 "$"<expression>=<string right> (test)
C753 <expression><relation operator><expression>!<expression>
C75B "<expression> = "<expression> (test)
C764 "<expression> <="<expression> (test)
C76D "<expression> <>"<expression> (test)
C774 "<expression> < "<expression> (test)
C77B "<expression> >="<expression> (test)
C782 "<expression> > "<expression> (test)
C78B <expression>
C79A "<term> +"<term>
C7B7 "<term> -"<term>
C7D3 "<term> !"<term>
C7EF "<term> :"<term>
C80B <term>
```

continued on page 125 ▶

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```
C813 "<factor> *"<factor>
C85E "<factor> /"<factor>
C870 "<factor> %"<factor>
C87B "<factor> &"<factor>
C89C "<factor> ?"<factor>
C8B3 "<factor> !"<factor>
C8BC <factor>
C8C1 "-"<unary plus>
C8C4 Negate number on acc stack
C8DC <unary plus>|"+"<unary plus>
C8E1 "<variable>" (extract value)
C902 "ABS"<factor>
C90A "#"<hex number>
C944 (<testable expression>)
C94C "?"<factor>  (extract value)
C95F "!"<factor>  (extract value)
C973 "TOP"
C97A "COUNT"
C986 "RND"
C99F Push 00,Y .. 03,Y on acc stack
C9BD "LEN"<factor>
C9D2 "CH"<string right>
C9D8 Default BRK handler routine
C9E7 BASIC error routine string
CA24 Handle unrecognised <unary plus>
CA2C Get <expression>, then ..
CA2F Assign variable
CA4C Print a character (with COUNT)
CA51 "LIST"
CACD "NEXT"
CB57 "FOR"
CB81 "TO"
CBA2 "STEP"
CBD2 "GOSUB"<go entity>
CBEC "RETURN"
CC05 "GOTO"<go entity>
CC1F <go entity>
CC81 "INPUT"<input section>
CC8E Handle <variable> in <input section>
CCB6 Handle $<expression> in <input section>
CCD2 "UNTIL"<testable expression>
CCF0 "DO"
CD09 Input a line (for INPUT)
CD0F Input a line (for immediate mode BASIC)
CD54 Print a CRLF (with COUNT)
CD5C "$"<expression>=<string right> (assignment)
CD75 "<variable>!"<factor>=<expression> (assignment)
CD7B "<variable>?"<factor>=<expression> (assignment)
CD98 "END"
CDBC Add Y reg to TOP, set Y=1
CDC9 Deal with BASIC line insertion/removal
CE83 Do rest of "RUN" (from routine at F141)
CE93 "?<factor>"=<expression> (also used by "!")
CEA1 Add Y reg to pointer at #58,#59; set Y=1
CEAE Get =<string right> (ready for assignment)
CEB6 Set up "$"<expression> (ready for assignment)
CEBF Set up string in quotes (ready for assignment)
CEED "LOAD"<string right>
CF0A "SAVE"<string right>
CF28 "EXT"<factor>
CF29 "PTR"<factor> (extract value)
CF3E Get <factor> into Y reg
CF47 "PTR"<factor>=<expression> (assignment)
```

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```
CF5B "BGET"<factor>
CF66 "GET"<factor>
CF7B Get <factor>,<expression> Then PUT LSbyte
CF8F "BPUT"<factor>,<expression>
CF95 "PUT"<factor>,<expression>
CFA6 "FIN"<string right>
CFA7 "FOUT"<string right>
CFB6 "SHUT"<factor>
CFC5 "SPUT"<factor>,<string right>
CFE3 "SGET"<factor>,<expression>

          EXTRA BASIC SECTIONS
F000 Tables for <statement> recogniser
F02E Unrecognised <unary plus> (from BASIC)
F03F "<array name>"<factor> (extract value)
F04B Unrecognised <statement> (from BASIC)
F085 "<array name>"<factor>=<expression> (assignment)
F0AE "DIM"<dim section>{,<dim section>}^
F141 "RUN" (from basic keyword decoder)
F14C "WAIT"

          ASSEMBLER
F155 Table of compressed mnemonic (MSB)
F195 Table of compressed mnemonic (LSB)
F1D5 Table of bit mask for addr modes (LSB)
F1E4 Table of bit mask for addr modes (MSB)
F1F3 Table of offset from base for addr modes
F202 Table of no of data bytes for addr modes
F211 Table of base value for mnemonics
F251 Table of addr mode group for mnemonics
F291 Get next non-space character
F29C "]" (back to basic)
F2A1 "[" (enter assembler)
F32E ":"<label name>
F360 <comment field>
F36B Put variable P in 52,53
F376 Print hex byte, followed by a space
F37E Print hex byte (sets X=FE)
F38E <assembler statement>
F3F2 Get addressing mode data and type
F454 "@"<expression>  (immed mode)
F462 "("<indexX>)|"("<expression>),Y|"("<expression>)
F482 "(<expression>)",Y|"(<expression>)"
F49B Construct opcode and data
F4EC Handle relative addressing

          MORE BASIC SECTIONS
F531 "OLD"
F542 "DRAW"<factor>,<factor>
F546 "MOVE"<factor>,<factor>
F54E "PLOT"<factor>,<factor>,<factor>
F5B5 Plot a line
F5EB Plot a line, with (X change)<=(Y change)
F61C Plot a line, with (X change)>(Y change)
F678 Plot a point (through vector at #3FE)
F67B "CLEAR"<factor>
F6C2 Clear mode 0
F6CF Tables used to CLEAR modes
F6E2 Mode 0 point plot routine
F73B Mode 1 point plot routine
F754 Mode 2 point plot routine
F76D Mode 3 point plot routine
F7AA Mode 4 point plot routine
F7C9 Bit table for graphics
```

continued on page 128 ▶

◀ from page 127

```
          CASSETTE HANDLING ROUTINES
FD71 Output ascii string after "JSR #F7D1"
F7EC Set reg X=D4, then ...
F7EE Print 2 2-byte numbers from 00,X in hex
F7F1 Print 2-byte number from 00,X in hex, then ...
F7FD Print a space
F802 Print A as 2 hex digits
F80B Print LSnibble of A as 1 hex digit
F818 Get filename in quotes from command line
F84F Transfer file control block, and test name
F876 Get next non-space char from command line
F87E Convert hex char in A to binary
F893 Get hex string from command line into 00,X and 01,X (uses 02,X)
F8BE Tables of OSCLI commands
F926 Print 'COM?', then error
F92F Load an un-named file
F955 "*FLOAD"
F958 "*LOAD"
F96E OSLOAD
F9A2 Check next block's header, and load block if OK
F9C7 Load block
FA08 Incr. 2-byte num at 00,X:01,X and test if eq to 02,X:03,X
FA19 "*NOMON"
FA1A "*MON"
FA20 "*RUN"
FA2A "*CAT"
FA65 Get a hex number, error if none
FA6B Get a hex number, and JMP there (not used)
FA76 Test for end of line, if not then ...
FA7D Print 'SYN?', then error
FA86 Save un-named file
FABB "*SAVE"
FAE5 OSSAVE
FB3B Save a block
FB78 Wait 2 seconds (tone to tape off)
FB7A Wait 2 seconds (tone to tape set by X)
FB81 Wait 0.5 seconds
FB83 Wait X/60 seconds
FB8A Wait 0.1 seconds
FB8E Read header info from tape, and test for un-named file
FBC9 Read name from tape & compare names
FBE2 Read rest of header info
FBEE OSBGET
FC23 Add A to checksum in #DC
FC2B Set load addr to be used
FC38 OSFIND
FC3E Print 'PLAY TAPE', then wait for key
FC40 Print message (depends on A), then wait for key
FC4F Print 'PLAY TAPE', wait for key
FC58 Print 'RECORD TAPE', wait for key
FC63 Print 'REWIND TAPE', wait for key
FCBD Count duration of tape pulse
FCCD Test for change in tape i/p level
FCD8 Wait for 1 falling edge of 2.4kHz signal
FCDA Wait for (X+1) falling edges of 2.4kHz signal
```

continued on page 130 ▶

◀ from page 128

```
            VDU HANDLING ROUTINES
FCEA Write char in A to screen
FD0B Handle ESC or ACK
FD1A Handle BEL (do a bleep)
FD29 Print a non-control character in A
FD44 Switch cursor
FD50 Handle DEL
FD5C Handle BS
FD62 Handle LF
FD69 Handle FF
FD87 Handle VT
FD8D Handle SO
FD92 Handle SI
FD9A 'LOCK' key pressed
FDA2 Cursor movement keys pressed
FDAE 'COPY' key pressed
FDC0 Other key groups pressed
FDEC Move cursor down, scrolling if necessary
FE2C Add 1 line to cursor position
FE52 OSWRCH
FE66 Wait for start of TV frame sync
FE6B Wait if not during TV frame sync
FE71 Scan key matrix
FE94 OSRDCH
FEC4 Decode control char or key number
FECB Table of control characters
FED7 Table of key-number divisions
FEE3 Table of control char action addrs (#FDxx)
FEEE Table of key-number action addrs (#FDxx)
FEF8 Write char in A to printer (if enabled)

            MISCELLANEOUS
FF3F Hardware RESET routine
FF9A Table of initial OS vectors
FFB2 IRQ/BRK routine
FFC7 NMI routine

            OS CALLS
FFCB OSSHUT
FFCE OSFIND
FFD1 OSBPUT
FFD4 OSBGET
FFD7 OSSTAR
FFDA OSRDAR
FFDD OSSAVE
FFE0 OSLOAD
FFE3 OSRDCH
FFE6 OSECHO
FFE9 OSASCI
FFED OSCRLF
FFF4 OSWRCH
FFF7 OSCLI

            MACHINE VECTORS
FFFA NMI vector (points to FFC7)
FFFC Reset vector (points to FF3F)
FFFE IRQ/BRK vector (points to FFB2)
```

Listing of Atom Basic and cassette operating system ROM routines

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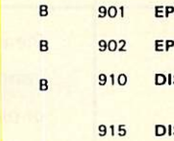
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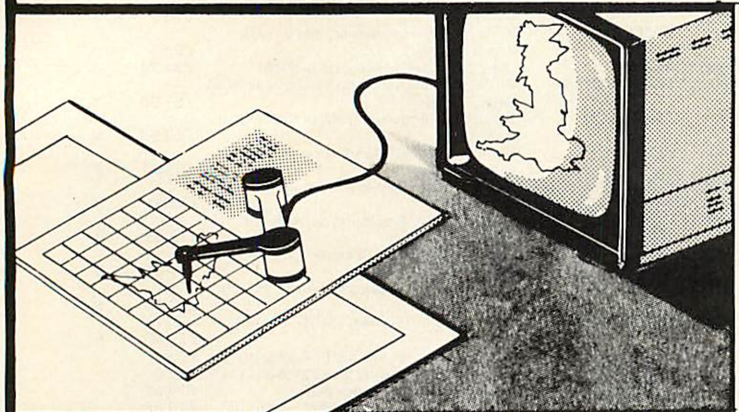
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TRANSLATING FROM B TO A

Subtle syntax points separate BBC Basic from the Atom dialect. Barry Pickles offers a conversion kit to those fluent in AtomBasic

IT IS apparent from your letters that many of you, having been weaned on AtomBasic, find BBC Basic (and other Microsoft-type Basics) difficult to relate to. Microsoft dialects account for about 99 per cent of all published Basic programs and the purpose of this short series is to guide you in the conversion of such dialects, so that you can get more out of *Acorn User* and, indeed, other magazines and books.

Acorn User in particular offers much information on programming techniques which, although written for the Beeb, are adaptable to the Atom. To whet your appetite, take a look at listing 1. This is a program from the excellent Acornsoft book *Creative Graphics on the BBC Microcomputer*. It's called 'Planets' and is often used to demonstrate the Beeb's graphic capabilities. Now take a look at listing 2, which is an Atom version of the same program (in black and white, to retain definition).

To begin at the beginning, table 1 lists those keywords which are syntactically identical in both dialects. However, there are some subtle syntax differences which can cause problems and you should be aware of these. From now on, whenever I refer to BBC Basic you can assume that I also mean Microsoft Basic, unless I specify otherwise.

Almost all Basic dialects run faster if integer variables are used wherever possible. BBC Basic uses the suffix '%' to denote an integer variable, otherwise it assumes a real (f.point) value. AtomBasic is just the opposite, using the '%' prefix to denote real numbers. Similarly, the Beeb refers to A$, rather than Atom's $A. You will occasionally see $A in BBC programs, but this is used when A has been assigned as a pointer to a string not stored in the usual area – in AtomBasic the syntax is identical.

DIM can also cause confusion. On the Beeb, strings are dimensioned using, for example, DIM A$(32). A statement of the form DIM A%(100) can mean one of two things. It can either be a byte array or it can reserve a specific block of memory for machine code – looking at the rest of the program should elucidate.

Print formatting uses the variable @%, but it is much more complex than the Atom's equivalent. We will shortly be publishing a program to simulate the Beeb version. The Beeb automatically prints a new line, unless you tell it not to, by using a semi-colon – again, Atom does just the opposite. Numbers prefixed by the tilde sign (~) are printed in hex, the hash sign (#) being reserved to denote an immediate operand in assembler. Just to confuse you, the ampersand (&) denotes a hex number in BBC Basic. Line labels are not allowed on the Beeb, so if you see the dreaded GOTO you can speed things up on the Atom. Variable names, functions and procedures may be named using multiple characters, upper or lower case. More of this later.

Now let's look at new keywords that you may encounter, and what to do about them.

ASC Used in the form ASC(A$), it returns the ASCII value of the first character in A$. The Atom equivalent is ?A. Some Basics have another form: ASC("A"). This returns the ASCII value of the character in the bracket. AtomBasic uses CH"A" to perform the same task.

BGET#/BPUT# Used only in Acorn Basics. The Atom uses the same function but without the # suffix.

CALL Same as Atom's LINK, except that the Beeb uses C% to specify the state of the carry flag and it also sets up a parameter block showing the type of variable that is to be acted upon and the limits of that variable – you cannot do this from AtomBasic, although a machine-code routine could be constructed.

CHAIN loads and then runs a specified program. This can be done using *RUN "<filename>" in the first program provided you *SAVE the second program so that it autoruns (see Atom Forum, October 1983).

**CHR$** returns the ASCII character corresponding to its argument. Same as P.$(x).

CLEAR clears (zeroes) all non-integer variables and arrays. A two-line subroutine will do this for us:

```
10000REM:Clear
10010 F.N=#2800 TO #288F
S.4;!N=0;N.
10020 F.N=#2EB TO #320
S.4;!N=0;N.;R.
```

CLG Same as CLEARn

CLS Same as P.$12

READ...DATA...RESTORE See Atom Forum, January 1984.

DEF FN/FN(x) No equivalent Atom routine, so you must either write the function out in full every time you encounter FN(x), or you could implement a function evaluation routine, using Bruce Smith's Extended Basic article in the December 1983 issue.

DEFPROC/PROC(x,y,z) Use a GOSUB, but watch out for local variables.

DIV simply means 'divide by'.

SOUND/ENVELOPE If you have the Atom sound board (see the May 1983 issue), you may translate these; otherwise you'll have to make up your own effects. SOUND parameters are channel/volume/pitch/duration. ENVELOPE parameters conform to the 14 registers of the sound chip.

EOR means 'exclusive OR'.

ERL/ERR—See ON ERROR

EVAL Same as VAL.

EXP means exponent. Atom uses

FALSE/TRUE A logical variable. FALSE has the value 0 and TRUE is −1 (see page 31 of the manual and Atom Forum, January 1984).

GET/GET$/INKEY/INKEY$ All perform the function of reading the keyboard. Those with the $ suffix store the key's ASCII value as a string variable. GET waits for a keypress, while INKEY(n) waits for n/100ths of a second, after which it returns a value of −1 if no key was pressed. INKEY with a negative parameter looks only for a specified key whose ASCII value is the parameter. Atom Forum for June and November 1983 give equivalent routines.

INPUTLINE A keyword peculiar to the Beeb, giving a new line for each item of

ABS	ACS	AND	ASN	ATN	COLOUR	COUNT	
COS	DEG	DRAW	END	EOF	FOR	GOSUB	
GOTO	IF	INPUT	INT	LEN	LET	LN	LOG
MOVE	NEXT	OR	PI	RAD	REM	RETURN	
RND	SGN	SIN	SQR	STEP	TAN	THEN	TO
TOP	VAL	UNTIL					

Table 1. Keywords common to BBC Basic and AtomBasic

input. You can do this, using the character.

INPUT# This gets bytes from tape and returns them in the specified variables. The first argument is the file handle. You will have to use multiple BGETs for this.

LEFT$/RIGHT$/MID$ See page 61 of the manual. We'll shortly be publishing a routine to add these words to AtomBasic.

LOCAL A powerful function, allowing you to declare that the variable(s) used in a function shall be local to that function and retain their original values outside it. Also used in procedures. The way round this is to assign the variable to a specific memory location, before entering the function/ subroutine, and recover the value on return.

LOMEM/HIMEM On the Beeb these indicate the lowest and highest addresses that can be used by a Basic program. LOMEM is equivalent to ?18*256. There is no Atom equivalent of HIMEM, which is usually manipulated to protect machine-code above it from being overwritten. You will just have to be careful.

ADVAL This reads a value at the Beeb's A/D port, normally from a games paddle. Most games don't need a true analogue, since control is of the up/down/left/right variety. Convert the program to a keyboard control or use an Atari-type joystick on the user port.

GCOL This is a colour manipulation command for which there is no Atom equivalent, the graphics chip on the Beeb being very sophisticated and having more colours. You will have to make the best of it you can. If you are using an RGB monitor, you could imitate a kind of GCOL using the circuit in the October '82 issue.

Next month we'll *finish off the* keywords and look at VDU calls. In the meantime, have a look at some of the Beeb programs in this issue and see what you can make of them. ●

```
10 REM Planets
20 MODE1
30 VDU5
40 REPEAT
50 VDU29,RND(1000)+100;
RND(800)+100;
60 LC%=RND(3)
70 SIZE%=RND(150)
80 SIZES%=SIZE%*SIZE%
90 FORY=-SIZE%TOSIZE%STEP4
100 X%=SQR(SIZES%-Y%*Y%)
110 X2%=2*X%
120 FORI%=-X%TOX%STEP4
130 IF RND(X2%)-X%<I% THEN
GCOL0,LC% ELSE GCOL 0,0
140 PLOT69,I%,Y%
150 NEXT I%,Y%
160 VDU19,LC%,RND(7);0;
170 UNTIL FALSE
```

Listing 1. 'Planets' program in BBC Basic (© Acornsoft 1983)

```
10REM Planets
11REM CONVERTED FROM
12REM BBC BASIC BY
13REM B.PICKLES : 1983
20CLEAR4
40DO
50 M=A.R.%170+20
55 N=A.R.%170+20
70 S=A.R.%25+1
80 Q=S*S
90 F.Y=-S TO S
100  Z=SQR(Q-Y*Y)
105  IFZ=0 Z=1
110  W=2*Z
120  F.I=-Z TO Z
130   IF(A.R.%(W)-Z)<I G.b
140   PLOT13,(I+M),(Y+N)
150b N.;N.
160U.0
```

Listing 2. AtomBasic version of 'Planets'

ROMS SOFTWARE FOR THE BBC MICRO

```
WORDWISE
(C) Computer Concepts 1982

1)  Save entire text
2)  Load new text
3)  Save marked text
4)  Load text to cursor
5)  Search and Replace
6)  Print text
7)  Preview text
8)  Spool text

ESC Edit Mode

Please enter choice_
```

WORDWISE

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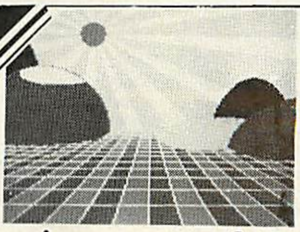
```
DISC DOCTOR 1.09
  DIS <<sta>> <<end>> <<ofs>>
  DISCTAPE <afsp> <<afsp>>...
  DOWNLOAD <fsp> <<adr>>
  DSEARCH <str> <trk> <<trk><sct><drv>>
  DZAP <<trk>> <<trk><sct><drv>>
  EDIT <<key no.>>
  FIND <str>
  FORM <drv> <no. trks> <<stt>> <<S>>
  JOIN <fsp> <afsp> <<afsp>>...
  MENU <<drv>>
  MOVE <<dest page>> <<src page>>
  MSEARCH <str> <<adr>>
  MZAP <<adr>>
  PARTLOAD <fsp> <ofs> <ext> <adr>
  RECOVER <trk> <sct> <sct> <adr> <drv>
  RESTORE <trk> <sct> <sct> <adr> <drv>
  SHIFT <src> <dest> <ext>
  SWAP <<drv>>
  TAPEDISC <<fsp>>...
  VERIFY <<drv>> <<no. trks>> <<stt>>
OS 1.20
>_
```

DISC DOCTOR

Following on from WORDWISE this utility ROM is the ideal way to get the most out of your computer system. This ROM adds 20 new commands to the Machine Operating System. Most of these are concerned with DISC operation although some of the commands are totally general purpose. Disc Doctor allows up to 60 files per side of a disc and includes its own disc formatting and verifying commands. Three search commands will find any string in memory or on disc, or will list all the line numbers in a BASIC program that contain the string. Many other features include disassemblers, disc/memory editors, function key listing etc. Works with all versions of the Acorn DFS, and other Acorn compatible DFS's. **£33.35 incl. VAT and p&p.**

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★WINDOW is a very much easier method of defining graphics windows than the normal VDU statement.

The above list is only a fraction of the commands in the PRINTMASTER ROM. Others include ★TAB, ★UNDERLINE, ★ITALIC, ★MARGIN etc. etc. which provide total control over the printer in the easiest possible manner. Order as PRINTMASTER (Epson). **£33.35 incl. VAT and p&p.**

```
PRINTMASTER (Epson) 1.00
  DEFINE <chr>
  FDUMP <<fsp>>
  FONT <country>
  GDUMP <<or,op>> <<X,Y>> <<gap>>
  GPRINT <str> <X,Y> <<or,op>> <<gap>>
  INITIALISE
  ITALIC <<on/off>>
  LINCH <lines per inch>
  LINESPACE <<a>> <</b inches>>
  MARGIN <<left>> <<right/+width>>
  PAGE <<inches/+lines>> <<skip>>
  PCODE <codes/$ASCII>
  PROPORTION <<on/off>>
  STYLE <str>
  TAB <columns ..>
  TDUMP <<udc width>>
  TEXT <<width>> <<shade>> <<height>>
  TPRINT <str> <chr> <<X,Y>> <<or,op>>
  ULOAD <fsp>
  UNDERLINE <<on/off>>
  USAVE <fsp>
  WINDOW
  WVALS
Press any key_
```

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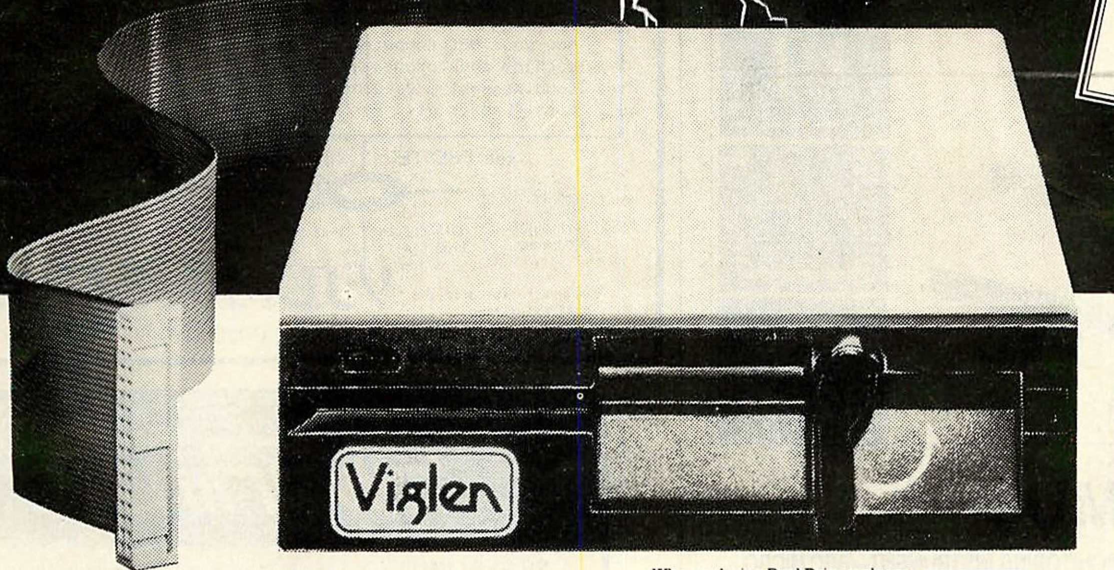
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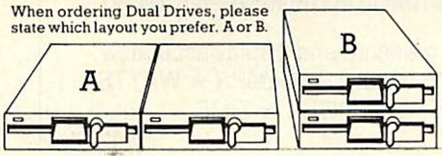




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WAGES OF SIN



Simon Dally involves you in the intimate concerns of the dungeon-dwellers – marriage and money

LAST year, as our regulars will recall, we had three popular excursions into the *Acorn User* dungeon. This month we're taking a look at how the occupants are settling in after tunnelling their way from Bedford Square to Covent Garden, and since so many of you have speculated on the absence of females, we thought the married quarters might be of interest.

First, for new readers, a recap of the characteristics of the inhabitants of the *Acorn User* dungeon. All inhabitants are either dwarves or trolls (apart from the odd visitor). Dwarves invariably tell the truth, while trolls are duty-bound to lie on all occasions. This makes life fairly simple for the dungeon dwellers because a dwarf knows that anything a troll says is the opposite of the truth, while anything a dwarf says is true. Unfortunately, humans cannot tell the difference between a dwarf and a troll – except by using logic (and maybe a micro).

The situation is made a wee bit more confusing by the fact that half the inhabitants are completely barmy and believe the truth is the opposite of what they should be saying. Therefore, if we pose a straightforward question such as 'Are there 12 inches in a foot?', the answers will be as follows:

Sensible dwarf: Yes (always tells the truth).
Barmy dwarf: No (believes the opposite of the truth).
Sensible troll: No (lies about the answer).
Barmy troll: Yes (believes 12 inches don't make a foot and then lies about it).

Before being shown the married quarters, you have to solve a puzzle set by the blabbering Mad Alex, newly promoted to guardian of the entire dungeon ('only 12 gold pieces entry money to you, squire').

As you enter the hellish hole, Mad Alex springs out and grips you by the arm to tell you his latest tale. It's all about his own personal RAM which is in something of a state bitwise – in fact, he thinks he needs a sideways ROM to solve his problem. Then, from his left earhole, he produces a listing which reveals the monthly salaries of six dungeon employees. It reads:

	Gold pieces
Squirrel Stuffer and Owl Feeder	1,100
Owl Feeder and Electron Eater	1,700
Electron Eater and Second Processor Hoarder	1,100
Second Processor Hoarder and QL Quasher	3,300
QL Quasher and Gong Hunter	5,300
Gong Hunter and Owl Feeder	3,200





Mad Alex then stuffs the listing into his mouth, masticates, swallows and burps before explaining that to win the prize money you have to start by working out what each of these six employees earns. And then you have to juggle these figures to produce a winning number (which we'll now go on to explain).

En route to the married quarters Mad Alex explains that the mating habits of dwarves and trolls are fairly similar to those of humans. In the married quarters a strict policy of apartheid rules: no dwarf can cohabit with a troll under any circumstances. On the other hand there is no restriction on the sanity of the various couples – it's fine for a sensible troll to be married to a barmy troll.

Before booting you out of the door Alex announces that if you return to his office and tell him the correct number of gold pieces he owes you after your tour he will give them to you, otherwise you will feel the hot end of his soldering iron for wasting time.

The rules are that you start with a figure equivalent to the number of gold pieces earned in a month by the QL Quasher. If a dwarf couple gives you a number you should add it to your figure. If a troll couple gives you a number you should subtract it from your figure (you keep a running total as you travel from room to room). The signs tell you what to do.

In addition, if you can determine the sanity – sensible or barmy – of any individual in a room you can award yourself a bonus of 5,000 gold pieces per room where you can make this deduction.

Now that everything's crystal clear you're on your own and here's the state of play.

Room 1
He: My wife is a troll.
She: My husband is a dwarf. One of us is sensible and one of us isn't.
Sign reads: Number of gold pieces = Gong Hunter's salary.

Room 2
He: My wife is barmy.
She: My husband always tells the truth.
Sign reads: Number of gold pieces = Squirrel Stuffer's salary.

Room 3
He: We're both barmy.
She: That's correct!
Sign reads: Number of gold pieces = Owl Feeder's salary.

Room 4
He: We're both trolls.
She: That's correct!
He: We are either both sensible or we're both barmy.
Sign reads: Number of gold pieces = Second Processor Hoarder's salary.

Room 5
He: At least one of us is barmy.
She: That's not true!
He: We're both dwarves.
Sign reads: Number of gold pieces = Electron Eater's salary.



Back you go to Mad Alex and announce how many gold pieces he owes you (having first fused his soldering iron). What's the answer? (By the way, your entry fee is refunded.)

Two pieces of astounding Acornsoft wares await the first three correct entries out of our sack. Answers on a postcard, please, to arrive not later than May 4, 1984, to: April Competition, Acorn User, 68 Long Acre, London WC2E 9JH.

BUG-EYED WASPS WITH THE STING OF DEATH

Attack on Alpha Centauri, Software Invasion, BBC B, £7.95 (disc £11.95)



THIS game is *Galaxian* in its ultimate form. But if you are put off by anything that resembles a previous game, don't be. *Attack on Alpha Centauri* is excellent in its own right.

As in most games of this type, you have three lives in which to destroy a constant stream of aliens – in this case multi-coloured, bug-eyed wasps that swoop and drop bombs on you. The setting is a mountainous, volcanic planet. This is well drawn in high-resolution graphics, making good use of colour to provide an ideal landscape.

When you start the game the wasps 'explode' from their volcanic hiding place to take up four ranks at the top of the screen, each rank progressively larger the lower down the screen, resembling an invading army. You move from side to side at the bottom of the screen, and of course score more points for destroying the moving targets than the stationary ones.

The most impressive thing about the game is that as the creatures peel off and swoop to attack they loom towards you to drop their bombs and then fade into the distant landscape. The 3D effect is most appealing and executed very smoothly.

The sound effects are very good but are constant and loud and can become overbearing. Fortunately, you can turn the sound on or off, even during play. The game is fast and furious so it is nice to have a pause facility available during the game, for when your eyes become blurred or your finger starts to ache.

One thing missing is a joystick facility – this may not matter to some, but it annoyed me.

Unfortunately the landscape remains a constant feature, as it is loaded before the main game. This is not unpleasant but means it cannot be removed to provide a league table. Nor is there an option to alter the level of difficulty. Despite these minor points, though, the game is very good, thanks mainly to the graphics. It is good value for money and I'm certain it will appeal to most. **Ian Rowlings**

TREAD CAREFULLY

Mined-out, Quicksilva, BBC B, £4.95

MINED-OUT is a refreshing change from the usual 'blast 'em out of the sky' derivatives. The object of the exercise is to get safely across nine minefields to rescue our poor hero Bill the Worm.

The mines are hidden from view but a 'beep' warns you if you move near one or more of them and the screen status line tells you how many (one to three) are in the immediate vicinity. Hitting a mine is fatal, but with a careful blend of backtracking and logical deduction, you can slowly carve a safe passage through the minefields. A couple of damsels (who wave tantalisingly at you) are trapped within each minefield, and extra points are yours if you can rescue them.

To stop you taking too long over each move, a number of additional hazards come into play. Periodically, a mine-laying creature flits across the screen, laying a carpet of extra mines, visible this time. At level four and above a bug chases you along the path you are clearing through the minefield. Although it moves rather slowly, contact is deadly. A further hindrance is an electrified fence which occasionally materialises. It doesn't kill you but you can't get through it.

If all this seems impossible, it's worth remembering that the minelayers not only add extra mines but also remove some of the hidden ones. So paths do not necessarily remain blocked.

One small complaint is that demonstration and instruction files have to be loaded before the main program can be executed. The demonstration is quite entertaining the first time through but quickly wears thin. It would be helpful if the game could be loaded and run in isolation.

If, like me, you find 'invader' variants a little fast and prefer time to think about your moves, then *Mined-Out* is certainly recommended. Although loading seems unnecessarily long-winded, the game has lasting appeal and is good value. **Vincent Fojut**

FACTORY ACTS

Felix in the Factory, Program Power, Electron £7.95

FELIX in the Factory is one of the first batch of Program Power cassettes launched for the Electron, and, after playing *Killer Gorilla*, I was eager to put this one through its paces. I was not disappointed.

It involves climbing up and down ladders, running across conveyor belts and avoiding 'gremlins' in your struggle to retrieve the oil can, which allows you to maintain the level of oil in the generator. To make it more interesting, giant rats run across the screen, which you can kill with rat poison, and to help you past the gremlins you can pick up pitchforks to stab them.

The graphics are smoothly impressive, and to add a little variety the screen layout changes slightly each time.

However, it has its bad points: the controls are a little awkward – A/Z are up/down and P/↑/↓ are Left/Jump/Right. Why did they not stay with the better controls used in *Killer Gorilla*? Sound is also used far too sparingly.

Nevertheless, a good game once you have mastered the controls.

Robert Sassoon

RICH NEW WORLD

Gateway to the Skies, Solarsoft, BBC 32k, £8 (disc £10)

I EMBARKED on my adventure, feet firmly on the ground, in a deserted village square. Searching the village and surrounding areas, I found the equipment and supplies necessary for my perilous journey. The solution to the puzzle of how to leave Earth made me think hard but at last I was away. Finding myself offworld in the Kingdom of Lataeri, standing by the beautiful Fountains of Yorith, I basked in the warm sun under a yellow sky. The time had come to set about exploring this new world, to find its many treasures – if I could avoid death in fiendish traps. Luckily, while back on Earth I had been vigilant and collected clues which were now saving my life. So on I went. . .

Gateway to the Skies is not one but two programs. Part one must be completed before part two can be started. This gives a total playing area of more than 34k, with more than 100 locations full of tricks, traps, monsters and treasure to explore and conquer.

After playing the game for three days, I've come close to completing the first part. I found it entertaining with a good balance between skill and trial and error. It has a load/save facility, which means that the fearless explorer need not restart from the beginning if killed.

There is a minor bug – the game restarts if you are not carrying anything when leaving the furnace room.

The game has no sound or graphics but is a good 'traditional' adventure representing good value for money. **Ken Worrall**


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displays the co-ordinates of your screen area. The co-ordinates are based on the screen with a grid size of 1023 x 1279 pixel, also in the Grafpad giving you a grid size of 320 x 256 pixels!

THE SECOND PROGRAMME

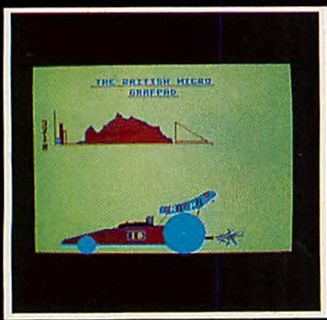
provides you with the utilities for circles, squares, triangles, free-hand, erasing line-drawing etc, and of course, full "Fill-in" facility in 16 different colours by the simple use of the pen!

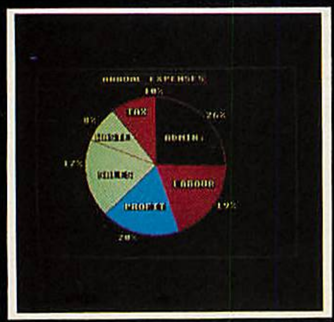
Draw from a simple apple to a computer circuit - store in cassette or disk, perhaps transfer direct to a printer - in black and white or full glorious colour!

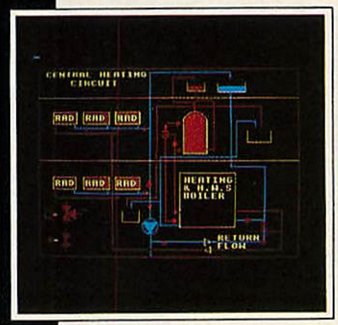
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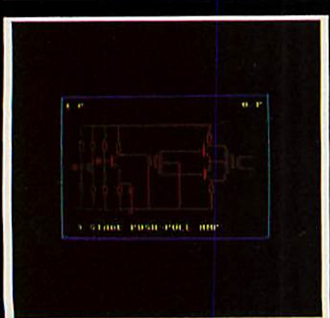
(Size: 25mm height x 55mm width x 260mm depth)
Weight: 1.2 kg (Gross)

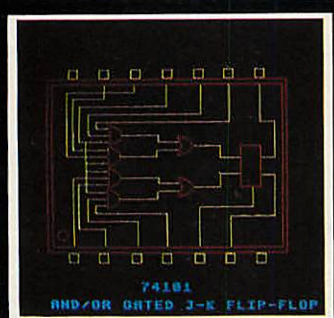












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EMS

THREE STARS FROM THE EAST

How does a trio of Japanese printers shine in the dot-matrix firmament? Here are some observations from George Hill

PRINTERS seem to be coming down in price and going up in quality at almost the same rate as micros. Three printers from Star, in the budget price range of £200 to £400, are the DP8480, the Gemini 10X and the Delta 10, and they conveniently lend themselves to comparisons with other models on the market. Star printers in general bear an uncanny resemblance, particularly in their command sets, to members of the Epson range, and these models are no exceptions.

All three are dot-matrix printers of the conventional type. The 8480 has a seven dot-wire head, and the Gemini and Delta a nine dot-wire head.

The DP8480 has been superseded and only end-of-range models are now available. My review machine was from CJE, which supplies it complete with serial interface, graphics character ROM and dumping software.

It has a fairly extensive repertoire of printing styles, and a more attractive character set than the Seikosha, with which it compares in price. It has a rather awkward and slow graphics character set, based on a six-wide, single-dot deep extra character set that curiously brackets some Japanese characters in the ROM. This is inconvenient and slow, even when driven in machine code, and cannot do the one printing wire much good in the long term. However, it is built like a tank, uses ordinary reel-to-reel ribbons (much cheaper than cassettes), and I preferred it to the Seikosha.

The Gemini 10X (review model supplied by Micro-Peripherals) is much more sophisticated. It is an upgrade of the Star 510, which I know only by reputation and from readers' letters. It is neatly packaged and supplied complete with paper separator and roll-holder. Parallel interface is standard, and serial would be a fairly costly extra. No interface cable is included in the basic price.

The variety of printing styles available is much the same as on the Epson FX80, that is, Pica, Elite, Condensed, Expanded and Italic. It can underline and produce ugly (MX80-type) sub- and superscripts. It also has some built-in special characters, including block graphics, of which examples can be found in my article on dumping the Teletext screen (March issue). The text example (Figure 1) illustrates the capabilities.

The pin-addressable graphics capability is almost identical to that of the Epson MX series, so the graphics dumps published so far in *Acorn User* for the MX80 will work on these Stars. Some other graphics dumps use the ESCape 3 code, and these differ slightly. There is 'quadruple density' graphics, but all the graphics capabilities suffer from the Epson problem – an inability to produce a true circle simply – and are certainly no match for the FX80's.

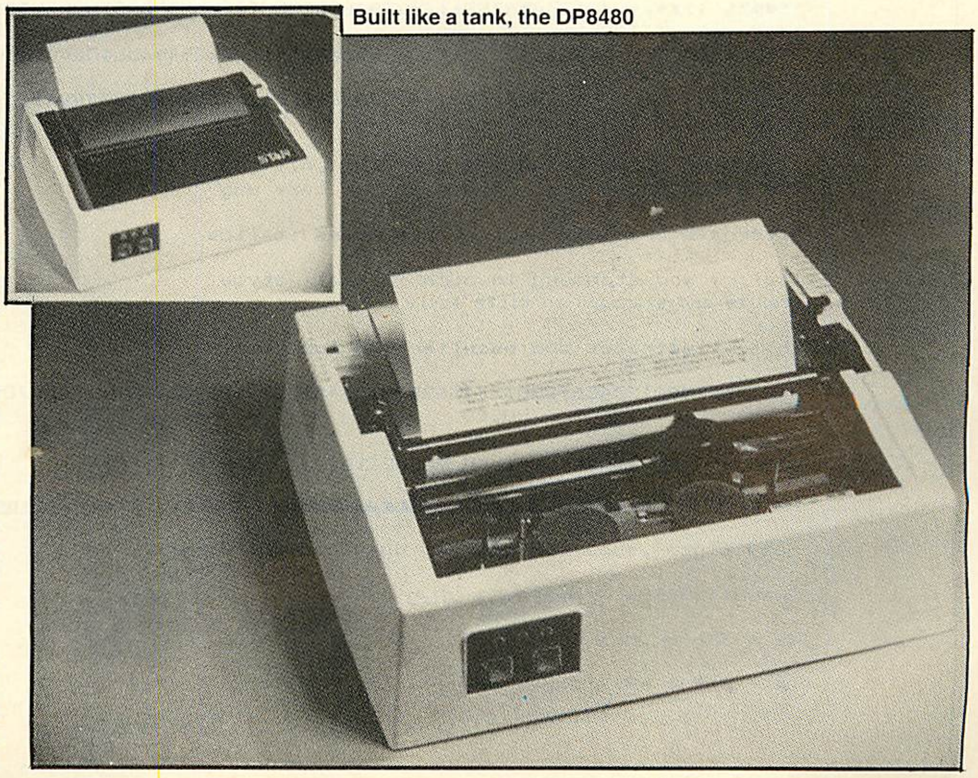
The way in which the characters have been arranged on the 10X differs radically from Epson's. The normal set consists of 256 characters (if you include controls and blanks), of which the printing set from 32 to 126 are the ordinary ASCII set with nationality options, and 160 to 255 are special characters, including block and 'box' graphics sets of 16 characters. The italics are in an alternate character set which can be switched in and out by ESC 4 or 5. In this set characters 128 upwards have no extra meaning.

There is a 'download' character set, ie, user definable characters. This would seem to make the Gemini a serious rival to the much higher priced Epson FX80, but in practice the capability is much more limited.

There are only 96 definable characters, as against an apparent 256 on the Epson (though you would be foolish to redefine the control characters), and the download set cannot be mixed with another set on the same line. This really limits the use, as the download characters are frequently needed as *extra* characters, not replacement ones. The characters are defined on a 9 × 7 matrix, using a different system from the Epson. This has the advantage of *not* requiring sequential ASCII values but the disadvantage of being incompatible with Epson and even its own stablemate, the Delta.

The Gemini 10X is neat, sturdy and quiet and handles the paper efficiently using friction or standard tractor feed. It is fast at 120 cps, with a rapid linefeed and the usual bi-directional, logic-seeking features. It also uses a typewriter ribbon, not a ribbon cartridge – a little messier but much more economical.

Setting the DIP switches reveals a pecu-



Built like a tank, the DP8480

liarity. Why should the Continental character sets be linked to a 12-inch page length, while the UK and US have 11 inches? The DIP switch for setting the paper-end detector, the print buffer, 7/8 bit word length and automatic linefeed is external, which saves taking the lid off.

Two criticisms: when printing block graphics I detected a misalignment of the characters on the forward and backward printing strokes, and the smart smoked-glass effect cover is too opaque to be able to see the printing clearly. I had to take it off to see what was happening, particularly when resetting to the top of a page.

The Delta 10 (also from Micro-Peripherals) is Star's fully upgraded offering. It is almost identical in appearance to the Gemini, but has a number of extras.

First, it is faster (160 cps), and my impression is that, because of the faster linefeed, it is quicker than the Epson FX80, with which it is intended to compete. The increased speed has resulted in different sounds, including a less than pleasant whistle-while-you-print. The speed is further enhanced by the large buffer, so that the micro becomes almost instantly available for other tasks, unless you are printing a very long program or a piece of text of more than 1,000 words.

Second, it has the serial interface board fitted as standard. There is a consequent change in the operation of the DIP switches, and the external switch sets serial/parallel in place of the buffer-full printing.

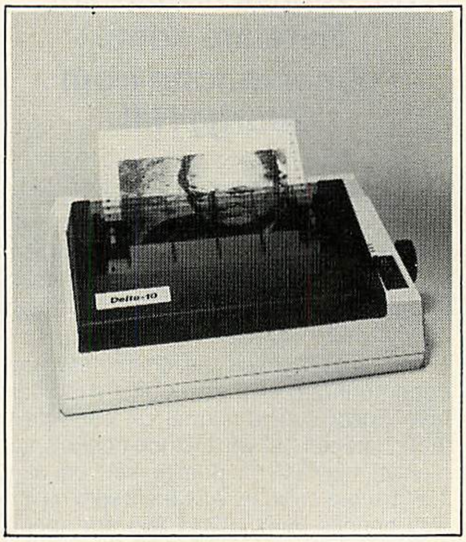
Third, it has a much more powerful set of download characters, with proportional spacing. A curious feature of the printer is that there seems to be no way of using the normal characters in proportional mode, although your own defined characters have proportional characteristics. The download characters are on an 11 × 7 matrix, with two-dot descenders available. Characters can be defined in the ranges 32 to 126 and 160 to 254, making it possible to use the full normal set, plus your own defined characters on the same line.

The 'temporary' manuals are tatty affairs giving only bare information and little proper guidance, and a preview copy of the American version was incomplete and verbose.

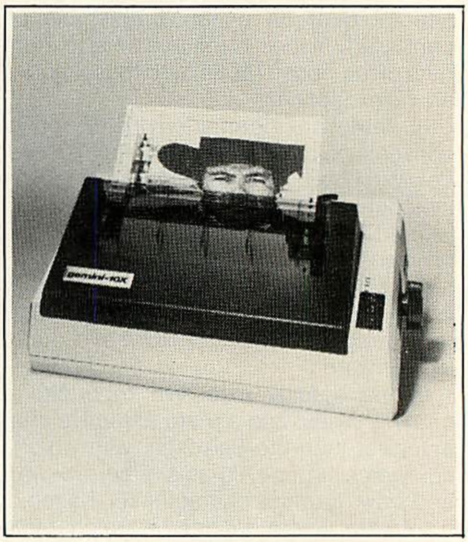
What do you get extra if you buy the Epson FX80 at a much higher price?

You get much better graphics capabilities, particularly the CRT and plotter graphics, which allow fully accurate screen dumps, with genuinely round circles; you get a more flexible mix of character sets, with proportional spacing available on all characters in most styles; you get slightly more accurate printing, though this is unlikely to be noticeable under most circumstances, and the ability to reverse linefeed. You do not get any block graphics characters, the serial interface as standard, or any better character sets. The Epson and Star sets are virtually indistinguishable, and neither is very beautiful.

Both Gemini and Delta are good value for money. ●



Delta 10 – Star's fully upgraded offering



Gemini 10X – neat, sturdy and quiet

STAR DELTA 10 full character set. (GEMINI 10X is identical.)

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnop
qrstuvwxyz{|}~
[illegible]
!"#$%&'()+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnop*
qrstuvwxyz{|}~

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog

Alternate character set - this means italics

Italics and standard in pica (normal) style
Italics and standard in elite style

This illustrates the peculiar TAB function.

0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
^POS1 ^POS20 ^POS50

Any word or <u>letter</u> may be <u>underlined</u> in <u>any</u> style

All types of print and graphics ▲▲▲▲▲▲▲▲▲▲▲▲▲▲ can be <u>mixed</u> on one line

Subscripts ,superscripts and download characters

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

$(a + b)^2 = a^2 + 2ab + b^2$

Figure 1.

THE ATOM FROM A VARIETY OF ANGLES

Atom Magic Book, edited by Mike Lord, Timedata (80pp), £5.50.

THIS was the first Atom book to appear. Edited by Mike Lord, it contains 28 programs, from single number guessing games to teletext simulation and speech storage. All the listings are bug-free and with each comes a full description of how the program works, with interesting routines noted, so that you learn as you program. At the end of the book are eight sections of useful notes and program tips.

Atom Magic Book also set the standard when it was first published and was rightly acclaimed. It is mandatory reading for any Atom user.

Atom Business by John Phipps, Acorn/Phipps Associates (110pp) £6.95

WRITTEN by John Phipps, *Atom Business* follows the *Magic Book* formula. It contains 11 programs useful for the small businessman, from a basic addlister, through discounted cash-flow forecasting to complex items like nominal ledgers and queue simulation. Along the way each program is dissected and some useful programming tricks shown. Idiot-proof instructions are given for non-programmers.

The Atom has never really been seen as a small business machine, but it does provide a low-cost entry-level system and this book helps to use it to full advantage. Highly recommended.

Atomic Machine Code, Ecce Productions (111pp), £5.75

AGAIN using the *Magic Book* format, here are 23 programs all in machine code. Again, the idea is 'learn as you program'. Most of the programs are utilities – indeed, you could build your own toolkit using this book, including character design, data storage and sorting. The programs are often lengthier than they need be, but this is not a bad idea for newcomers to machine code, since it makes it easier to follow the action – when you begin to see short cuts, the book has served its purpose! The programs include a pools predictor (I've tried it, but I'm still not a millionaire) and a pontoon game that cheats. Each listing is fully annotated and a sectional description is also given. Useful ROM routines and a 6502 instruction set are given at the end of the book.

Machine code is noted for its ability to reduce otherwise sane people to gibbering idiots. If you are having trouble with the 'blue pages' in the Atom manual, using this book should provide you with many practical examples to learn from. A cassette of the programs is also available, price £11.50 and buying both together costs £15.50. Well recommended.

Getting Acquainted with your Atom by Tim Hartnell and Trevor Sharples, Interface (184pp), £7.95

THIS is an introductory book for those who find the Atom manual hard-going. It starts from absolute basics, introducing each concept in an easy-going style, illustrated by games programs. Each chapter builds on the previous one, adding new concepts, so that you learn without really being aware of it.

There are more than 80 programs in this book, covering almost every type of game. Authors Hartnell and Sharples are well-known computer journalists. That being so, there is no excuse for the number of errors found in the listings. Their approach to learning has much to commend it, but it fails miserably when, time after time, the listings given flag an error. A beginner would be too easily put off the subject by incomprehensible *'mistakes'*. To be fair, the listings are reproduced at the end of the book, largely without fault, but I cannot recommend this volume, except as an exercise in de-bugging.

Wake Up Your Atom by Brian Lloyd, Timedata (128pp), £4.95

THIS new book for the Atom contains 20 programs and a number of hints and tips. The text is printed on a reasonably clear dot-matrix printer and all the listings have been dumped from running programs. That being so, there is no excuse for the number of errors which I found when typing them in. Indeed, in one case (Directory) the sample run could not possibly have been obtained from the listing shown, since the listing provides no means of interrogating the database!

None of the errors is difficult to spot, but they could confuse a beginner.

The programs themselves are mostly games and make use of the Atom's sound and colour facilities, but they tend to be inelegantly written and the author has a habit of not using one line where five will do.

As it comes from the publisher that produced the excellent *Magic Book*, many users may be tempted to buy the book, but it shows all the signs of having been prepared in haste. I would not recommend it, unless you are prepared to do a lot of work on the listings.

Barry Pickles

IT'S A BARGAIN: FIFTEEN NEW COMMANDS FOR THE BEEB

Toolkit, Ecce Productions, BBC B, £3.95

AT £3.95, Ecce's toolkit must be one of the cheapest ways to add 15 new commands (plus variants) to the Beeb, all accessible *via the '*' prefix*. The commands cover three major areas – Basic program analysis, machine code analysis and general memory examination.

For Basic, there are commands to list and fix 'Bad Programs' and list all valid programs in memory (*LBP, *FIXP and *LVP respectively). *FBA finds any specified Basic words, optionally followed by a string. An extra formatting facility, *LF, lists multi-statement lines as one statement per line. *SVAR and *VAR permit different variable types (and, optionally, their values) to be examined. For example, *VARAV should display all array variables and their values. Two additional commands are for calling within Basic programs. *BL prints 'Big Letters' at specified screen co-ordinates, while *PD dumps a graphic screen to a printer. Finally, *KR allows function keys definitions to be examined and/or modified – a very useful facility.

For machine code inspection there is *DISS, a fairly standard disassembler, while *BRK provides a novel breakpoint handling or debugging facility. This prints the values of the 6502's internal registers whenever a BRK instruction is encountered. In addition, the values of the user-reserved zero-page locations, from &70 to &8F, are also displayed, so any effects of users' machine code on these locations can more easily be observed.

Lastly, 'general' memory inspection is controlled by three further commands – *FBY and *FS, to find a specified byte or string; and *MEMV, which gives a typical memory dump in both hex and ASCII.

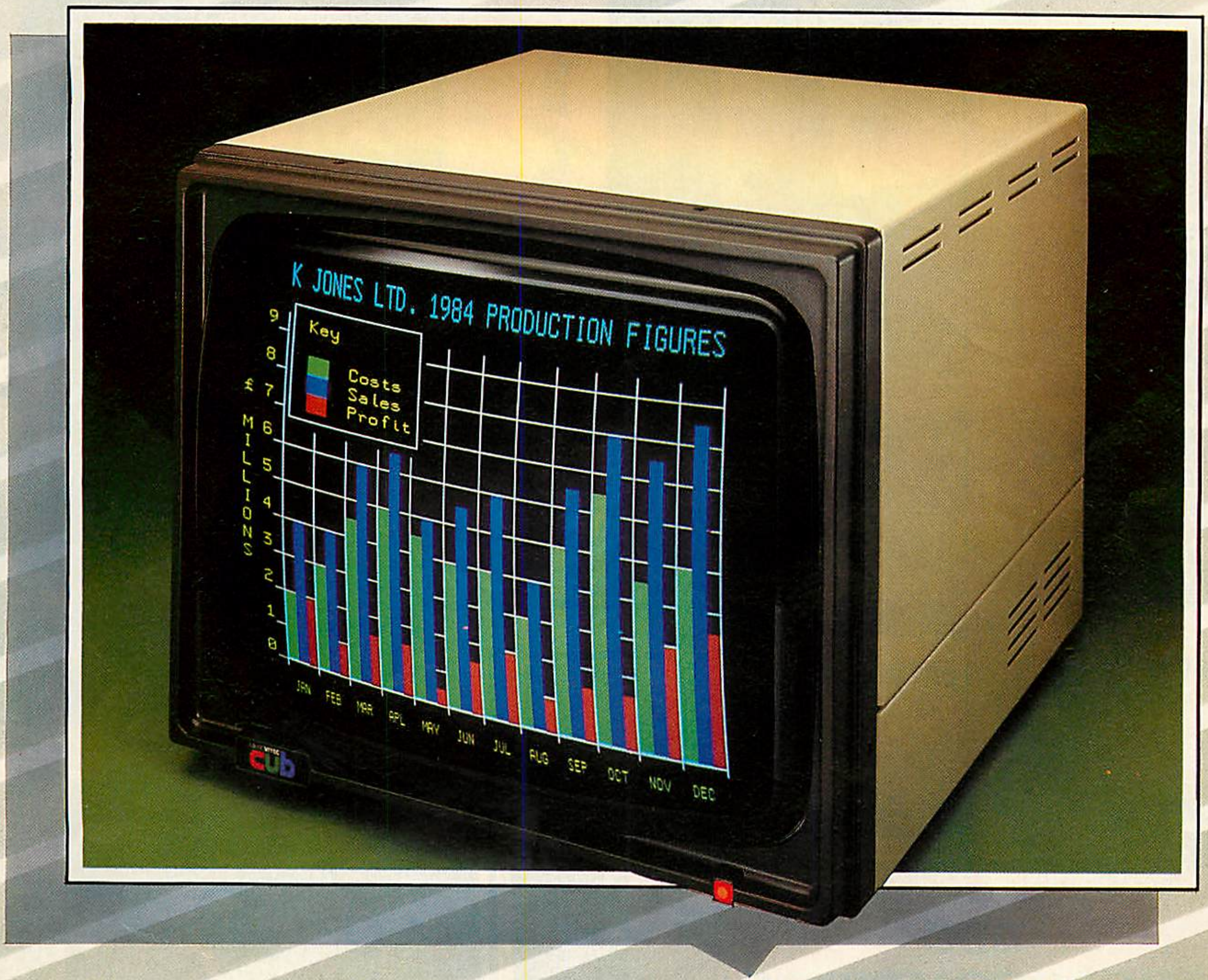
When entering parameters, such as start and end addresses, they are not accepted as part of the command line. Instead, the new '*' commands are entered in isolation and further sub-menus are displayed for subsequent parameter entry. This can get rather tedious. Most Basic-related commands, for example, persistently request the PAGE value to be entered instead of using the current value by default.

The version under review exhibited a fault in the disassembler program – the branch offset calculation printed an invalid address. One hopes this will be corrected in future releases.

The overall feel of the package is a little rough-and-ready, but, to be fair, many of the programs do just as good a job as similar routines in more expensive ROM-based offerings. And at such a low price, you don't have much to lose. In conclusion, an interesting and inexpensive product.

Vincent Fojut

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REAL-TIME MINDER

Bruce Smith keeps a date with the Acacia Diary and RAM Filing System

The Acacia Diary and Ram filing system, from Acacia Computers, 5 Coombe Lea, Bickley, Bromley, Kent, £150 inc VAT.

THE Acacia Diary and RAM Filing System enables you to transform your BBC micro into a versatile electronic diary system capable of reminding you of forthcoming appointments at predefined moments in time, whether you are watching the latest edition of M*A*S*H or whiling your evening away playing *Starship Command!*

The Acacia package contains three items: a real time clock complete with 4k RAM, an EPROM containing the system software, and a 35-page manual.

The RTC+RAM is housed in a standard RS-type white and grey box, measuring about 200×140×85mm and comes complete with integral ribbon cable, power lead and power-out connector. Removing the four base screws reveals the printed circuit board, housing the 4k of CMOS RAM (expandable to 30k), a real time clock/calendar chip and a high energy lithium inorganic battery providing a constant supply of volts, thereby making the onboard RAM non-volatile. The PCB is professionally produced, is silkscreen-printed, and has obviously been designed with expansion in mind. Both cables are fully secured, making it almost impossible to disengage them. A further port on the rear of the case is marked 'Alarm'. Internal to this sits an open-ended transistor capable of sinking 20mA – but more on this later.

The EPROM fits neatly into one of the sideways ROM sockets. If placed in the socket next to Basic the *RAM filing system will be automatically initialised when the computer is switched on. If you have discs, the choice of which one should sit next to Basic is yours, but giving the RTC+RAM priority has advantages, as we shall see.

Connecting the hardware is simple following the procedure described in the first chapter of the manual. The power cable fits readily into the auxiliary power output on the underside of the Beeb's case. If you have discs that normally take their energy from here plug the disc power lead into the power output socket on the rear of the RTC+RAM case. The ribbon signal cable fits into the 1MHz bus connector.

Switching on the Beeb brought up the Acacia copyright message, indicating everything was well. Executing a *HELP revealed the software to be version 1.13.

If a DFS has priority then the RAM filing system can be selected by typing *RAM. The system requires just 256 bytes of the program area for its workspace, thus PAGE is set by the software to &F00. All pointers used by the RTC are stored in 50 bytes of RAM held within the clock chip.

Three programs are supplied with the RTC+RAM, held in the non-volatile RAM. 'RWRAM', 'BUILD' and 'INIT' can be loaded into the user program area and saved on disc or tape by switching between filing systems, as program 1 demonstrates. RWRAM allows a backup copy of the RAM filing system's contents to be made to tape or disc. This may be restored at a later date using the same program. 'BUILD' enables auto-boot files to be created and 'INIT' is used to erase RTC+RAM completely.

The Diary system adds nine new commands to the Beeb's vocabulary. These are implemented as operating system commands, preceded by an asterisk, which makes them available when using other facilities such as Wordwise.

To have a diary you need a calendar and that's where the real time clock comes in. Date and time can be displayed by typing *TIME, which places a data line across the top of the teletext screen:

Thu 10 Nov   10:27:38 PM

The clock, updated every second, is available only in mode 7. *TIMD disables the clock display. Date and time can be set using *TIMS, though this will not often be needed. (The most obvious occasion being in the shift between BST and GMT). The command displays the current time, ie:

10:50:07

and the cursor can be moved to the rele-

```
MODE 7
*BASIC
*RAM
LOAD "RWRAM"
*DISC
SAVE "RWRAM"
```

Program 1. Transferring files between filing systems

```
10 REM **    CALLING THE RTC        **
20 REM ** FROM A BASIC PROGRAM **
30 A%=&50
40 X%=&70 : REM low byte of address
50 Y%=&00 : REM zero page user ram
60 CALL &FFF1
```

Program 2. Obtaining the date and time from the real time clock

```
10 REM ** RTC+RAM SPEED TESTER **
20 REM **  SAVE 3* 1K BLOCKS    **
30 TIME=0:*SAVE"123" 2000 2400:A%=TIME
40 TIME=0:*SAVE"ABC" 2000 2400:B%=TIME
50 TIME=0:*SAVE"FIN" 2000 2400:C%=TIME
60 TIME=0:*LOAD"123" 2000:D%=TIME
70 TIME=0:*LOAD"ABC" 2000:E%=TIME
80 TIME=0:*LOAD"FIN" 2000:F%=TIME
90 PRINT"SAVE TIMES  ";A%,B%,C%
95 PRINT"LOAD TIMES  ";D%,E%,F%

>RUN
SAVE TIMES     2     2     2
LOAD TIMES     3     3     3
>
```

Program 3. Save and load time under test

vant digit(s) using the arrow keys, to edit the time as required. A one-off calendar display can be produced with *DATD, and in a similar manner to *TIMS the date can be altered using *DATS.

Entries are made into the Diary with the command *DIAA, upon which you are prompted to enter items. Figure 2 illustrates the procedure. The current date is displayed, and this can be edited to set the date that the reminder is to occur. Hitting return will enter the current date. The next prompt is:

From?
(Power on, Time)

Hitting 'P' programs the RTC to display the reminder message the instant you turn the Beeb on at the date set. However, this only happens if the RTC+RAM EPROM is fitted as the priority filing system – in other words, if you've plugged it next to Basic. If

```
*DIAA  : Add a reminder to the Diary
*DIAD  : Display and/or delete reminders
*DIAK  : Display and/or delete all reminders containing specified
         keyword.
*DIAR  : Read and/or delete reminder(s) that have activated the
         diary.
*TIME  : Enable the continuous time & date display
*TIMD  : Disable the continuous time & date display
*DATD  : Display the time and date
*TIMS  : Set the time
*DATS  : set the date.
```

Figure 1. Diary system commands

```
>*DIAA
Date?  10 Nov 1983
From?
(Power on,Time) Time? 11:15:05 PM
Repetition? None
Entry :
Hello there all you Acorn Users!
*******************************************
*******************************************
>
```

Figure 2. A typical Diary entry

```
SHIFT F0  : No effect
SHIFT F1  : Red
SHIFT F2  : Green
SHIFT F3  : Yellow
SHIFT F4  : Blue
SHIFT F5  : Magenta
SHIFT F6  : Cyan
SHIFT F7  : White
SHIFT F8  : Flash on
SHIFT F9  : Flash off
```

Figure 3. Colour control

```
*CAT
*ACCESS
*DELETE
*INFO
*OPT 4,n
*EXEC
*SPOOL
*SAVE
*LOAD
SAVE
LOAD
```

Figure 4. RAM filing system commands

```
>*CAT
Option 0  (Off)

STEP          20 Oct 1983   11:21:00 PM
DESIGN        20 Oct 1983   11:50:00 PM
VIA           21 Oct 1983   11:18:00 PM
EPROM_PROG    21 Oct 1983   11:35:00 PM
ROM_CHECK     22 Oct 1983   12:52:00 AM
ROM_M.CODE    22 Oct 1983   08:02:00 AM

  DE  bytes free
```

Figure 5. Typical display of an index file

you have a DFS in this position the message won't be displayed at power on.

The alternative, 'T', allows you to preset the time that the message is to be initiated. When this date and time is reached an alarm, in the form of a continuous series of beeps on the internal speaker, is issued. Turning this off is performed by displaying the message that caused it with the command *DIAR. The alarm output could be used to activate other devices connected to it via a relay – in fact you could get it to switch on the Beeb to display its message!

The message can be repeated at predefined intervals ranging from one minute to 31 years(!) by responding appropriately to the 'Repetition?' prompt.

Finally, you can enter the actual message, which may take any format and any number of lines, with up to 200 characters per line, provided enough memory is available. All the normal editing facilities are included and a diary entry is completed by pressing Escape.

If the diary is being used in teletext mode colours may be included in the messages. The function keys are programmed to produce the colours as shown in figure 3. As it is actually the SHIFT-function key buffer that is used the normal function key use is still available.

Deleting diary entries is simple. *DIAD will display one by one any entries in the diary for a particular date; each entry is followed by a 'Delete Y/N' message which acts at your direction. *DIAK acts like *DIAD except that it displays only those messages containing a specified keyword. For example, entering '*DIAK KITTY' will display all messages containing references to a certain editorial assistant.

The Diary is provided with a very useful wildcard facility. In fact, two wildcards are provided, '#' and '*'. Wildcards allow words and filenames to be specified with a certain amount of ambiguity (great if you can't spell correctly). The hash character means 'match any character in this position', thus HOT, HAT, HIT and HUT all fit the bill of H#T. The asterisk can be used to match any number of characters, so that HOOT, HEAT and HALT will all fit H*T, as would the previous examples. It can also save a lot of typing; for example, the command *DIAK ANTIDIS* would be much easier than typing (a deep breath) *DIAK ANTIDISESTABLISHMENTARIANISM.

An OSWORD call is also implemented in the software, enabling the RTC to be read at any time. The call code is &50 and the X and Y registers point to a memory block of seven bytes, where the seconds, minutes, hour, day, date, month and year is returned. Program 2 shows how this call can be used from a Basic program.

The RAM filing system (RFS) is probably the quickest and quietest filing system I've encountered and there are no restrictions to the number of files that may be created. All the standard filing commands are implemented (figure 4). The index file is obtained in the normal manner using *CAT.

A typical display is shown in figure 5. As you can see, the format is a little different from normal. The first line displays the start-up option set by the *OPT 4 command, which is issued to determine the action taken by the !BOOT file. Next follows the file names with the times and dates they were entered. Finally, the number of bytes remaining is displayed in hex (a value that will be altered as entries are made or deleted from the Diary).

LOAD, SAVE and *LOAD, *SAVE, *SPOOL and *EXEC all behave in the usual manner, except they all performed super-fast. Program 3 is the one I used to see how quickly three 1k blocks of memory could be saved and reloaded. The save time for each block was a mere two-hundredths of a second, and re-loading was a trifle slower at three-hundredths of a second – probably the time the Basic ROM took to interpret the commands! Another nice aspect is that files are continuously updated so that it is impossible to create 'open-ended' files by forgetting to close them. Up to five channels may be open at any one time and files may be opened on more than one channel

*ACCESS allows files to be locked and unlocked. Wildcards are excepted in the file description so all files could be locked with:

*ACCESS *L

A locked file has an L postfixed after its catalogue information. Files may be unlocked with *ACCESS FILE – again the wildcard facility is available for use. Similarly, files may be deleted with *DELETE FILENAME; a 'Delete Y/N' prompt is offered to ensure that the file is not erased accidentally. *INFO can be used to determine the length, load and execution address of a file or files.

The instruction manual provides full details of each of the RTC+RAM's facilities and a clear description of each command and its uses. Four appendices are provided that include details on changing the battery. Although its life is expected to be in the order of 5-9 years it is recommended that it be changed every three years. The PCB layout and appendix description provide ample information on what should be a painless procedure.

The RTC+RAM provides a fast and efficient Diary and RAM filing system that is particularly simple to use. The filing system is limited by the small amount of memory provided, but it is much faster than discs. The Diary is its most useful aspect and I can see it being of great appeal to small businesses and the self-employed, though it is perhaps just a little expensive at £150. ●

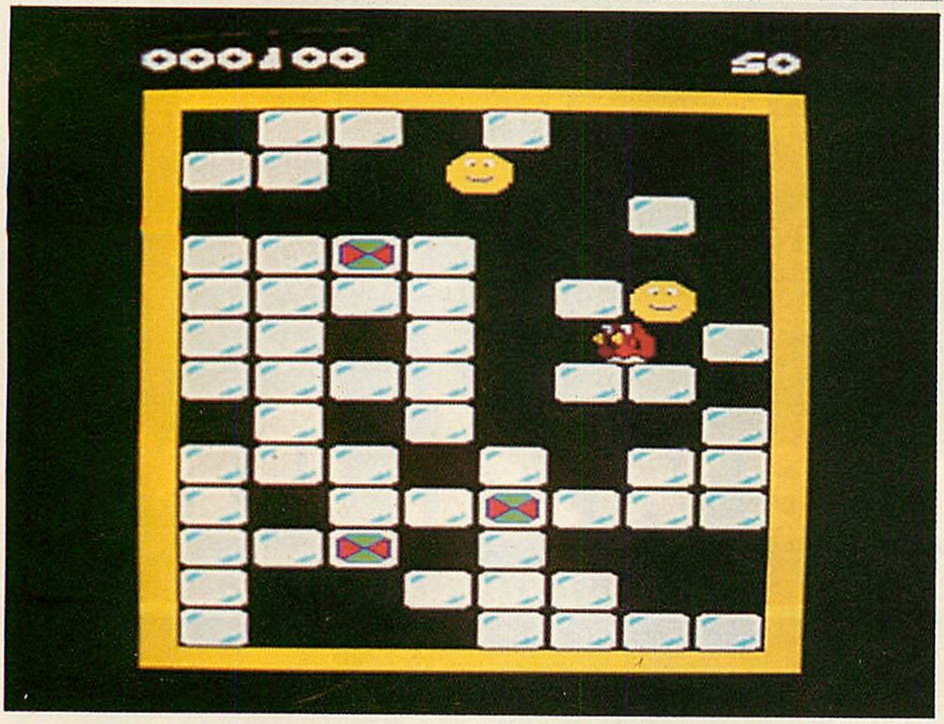
```
RTC+RAM COMPATABILITY

The RTC+RAM has been designed to be compatible with other
equipment and software available for the BBC Micro.

1MHz BUS                           &FCFE is used
Filing System type               : &10
Filing system select key         : A
Filing system select command     : *RAM
Channel number range             : &61 to &65
Tube handle                      : &F
OSWORD code number               : &50
```

RTC+RAM has been designed to be compatible with other equipment and software

PENGWYN AND A DASH OF ICE



Pengwyn, Postern, BBC B/Electron, £6.95

IS NO animal safe from the hands of that nasty species, the programmer? The range of creatures used in software is beginning to rival the famous Guinness zoo and this time round it's that lovable, funny creature, the penguin at peril. Well, not exactly a penguin . . . but a Pengwyn!

So, what's *Pengwyn* all about? At first sight, the game appears simple. It loads in three parts, and the challenge is to place three flashing blocks of ice in a straight line. Sounds easy. However, the flashing blocks are positioned randomly, and most of the rest of the screen is filled with ordinary blocks of ice. Pengwyn can move up/down and left/right. He (she) is controlled by four keys, and return enables the bird to move the blocks or melt them. A block of ice is melted if movement forward is obstructed, otherwise the ice cube will move.

Now for the difficult part. There are other animals around called 'Nasties' who also appear quite lovable as moving circles with a happy smile. But they too can melt ice and live up to their name by chasing Pengwyn. The only way our hero can defend himself is by hurling blocks of ice at the Nasties or dodging them. There's a time limit, so you can't afford to hang around.

It takes quite a while to get used to the game and work out a strategy. On the first screen there are two Nasties and three on the second. I haven't got any further to see how many more await!

The Nasties appear from within the ice blocks, so there is no way of knowing where they will come from – and every time one is killed it is replaced with another.

The screen display is very good and I really enjoyed watching the ice cubes melt. Pengwyn really stole the show for me, however, and he is defined so you can see him from the side, back or front, depending on the direction he is moving. You have three lives and if you succeed in lining up the flashing blocks, the screen clears and Pengwyn dances to the tune of 'When the Saints Come Marching In.' Bonus points depend on how much time you have used.

After the praise, the problems. *Pengwyn* is supplied on one tape for the BBC and Electron. However, the small print reveals that there are two versions, to take account of the difference in speed between the two machines. Fine, but finding the correct side for your machine is a game in itself, as the tape label is identical on both sides! I found this out by loading the Electron version on a BBC by mistake and was amazed by the speed – if you want it fast, this must be the ultimate game!

Overall verdict: excellent. It's is a pleasure to review a piece of software that is both novel and well written. *Pengwyn* has earned a place on my shelf with the likes of *Snapper*. Praise indeed! **Paul Richard**

JOEY'S PALS

Escape from Moon Base Alpha, Program Power, Electron, BBC B, £7.95

THERE are fast-moving graphic games and slow, absorbing adventure games. *Escape from Moon Base Alpha* successfully combines some of the features of both.

The game has 3D (perspective) colour graphics and makes sensible use of sound. Joey has been abandoned on Moon Base Alpha by his mutinous crew. His only hope of escape is meeting the Doctor, hidden somewhere on level seven, who for 10 bags of gold will transport him off the base in his Tardis.

The base is arranged on seven levels, nine rooms per level in a three by three arrangement. You control Joey using a sensible arrangement of keys and can actually see him move around the screen and from room to room.

To help Joey in his quest, bags of gold were deposited in certain rooms for him to collect. As well as essential for paying the Doctor, they increase his strength. He has a limited supply of hulk pills, which double his strength momentarily, thus allowing him to fight the more vicious monsters (more about those later) and to walk through walls; however, he pays for these privileges by a large forfeit in his overall strength. There is a wizard who will sell him a hulk pill or turn him back from a frog (mind you, he is never around when he is needed) and there's even a police box which will transport Joey to a random room on the same level.

There are many hazards for Joey to struggle against – Marvin, the manicly-depressed robot (from the *Hitch Hiker's Guide to the Galaxy)*, who bores him to death; the Metal Mauler (a Dalek), who tries to exterminate him; the Green Grappler, an over-grown frog, who reacts similarly to the Metal Mauler; and Deadly Doris (alias Evil Edna), a crazy TV set which, if she cannot kill Joey, will turn him into a frog.

The hazards make it an interesting game that will take you a while to get bored with; however, the instructions are long and appear as a program in themselves, and so are not available for reference once you've started the game. It would have been better to have them as a printed sheet.

Verdict – highly recommended.

Robert Sassoon

MELTDOWN

Atom Smasher, Romik Software, BBC A or B and Electron, £6.99

AT LAST an original plot to a game! The object of *Atom Smasher* is to stop the meltdown of a nuclear reactor. You control a 'remote controlled super-laser', your job being to shoot a proton, thus cooling the reactor down. But there are problems in the shape of electrons that collide with you, depriving you of one of your three lives.

The program loads in three parts: title screen, instructions and the game itself. There's a joystick option. The program is well presented but the game is a bit of a disappointment, being spoilt by the difficulty in controlling the gun. The sound effects are good and the graphics adequate.

Probably the main buyers of this game would be the model A owners. Model B owners can find much better games – although it's an interesting idea.

Richard Beach and Jason Mallen

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FALL GUY

Plankwalk, Virgin Games, BBC B, £7.95

VIRGIN has unfortunately gained a reputation for stylish presentation of mediocre games. *Plankwalk* may go some way towards rectifying this, but I suspect not far.

Scaffolding Sid, the hero of the game, is set on a screen of planks, blocks, 'power towers' and cherries (?) and it is your job to keep Sid on the screen by moving him left and right and jumping down from one level to the next. The planks scroll smoothly up the screen and, just to keep Sid on his toes, a small black monster chases him. Some of the planks, colour-coded for identification, have a built-in slope or are false (Sid falls straight through). You gain points by dropping Sid through the blocks, picking up the cherries and staying on the screen. Sid can move at two speeds, but uses energy at an appropriate rate.

The main problems with *Plankwalk* concern the use of graphics and the choice of colours. Sid is a simple stick man, like the one on the *User Guide* cover, the planks are single lines and the blocks are just that. The monster looks like a warmed-up space invader and the only attempt at multicoloured graphics in the entire game are the cherries. Add to this the fact that both Sid and the monster are black on a dark blue background, and it all makes for a fairly uninspired use of the micro's facilities.

Simon Williams

WATCH THIS SPACE

Cylon Attack, A&F Software, BBC, £7.90,

ON THE odd occasion you come across a piece of software that stands head and shoulders above the rest. *Cylon Attack* is such a game in every respect. Let us dispense with the scenario – a game of this class and quality needs little introduction. Devotees of *Battlestar Galactica* will know what it's all about. It is advertised as a 3D real time space battle and that sums it up perfectly. Nearer to reality on the BBC I could not imagine.

You launch from your mother-ship to search for and destroy a wave of enemy ships. Your cockpit provides a long-range scan at the top and readouts at the bottom of the state of your shields, fuel and laser power and the ship's attitude. The simulated view of space ahead of you is extremely well done. In the star-studded blackness you will come across the odd planet or two, and even a Tardis and a signpost (someone's got a sense of humour).

When an enemy ship comes within scanner range it swoops towards you, looming larger all the time, with a relentless and frightening reality. The shape of your sights changes to indicate a good chance of destroying the enemy ship as you lock onto it. You should aim to do this before it fires back. If you don't, you'll have to out-run its missiles and each hit you suffer reduces your shields – lose them or your fuel and you've no chance.

The object is to destroy the entire wave before running out of fuel. If you run low you may refuel from the mother-ship, but you are open to attack during the process. If you destroy the full wave you must return and dock with the mother-ship to refuel and replenish your shields before the next wave.

Docking – also realistically represented – can be a little tricky. As you attempt to lock on to the mother-ship it veers away from you. You must constantly adjust your position to maintain the mother-ship in your sights, until it looms large enough for docking to take place. This is even more difficult in mid-wave with the enemy ships attacking you at the same time.

Each successive wave involves more enemy ships of various shapes and sizes. Some, like the Cylon Base Ship, move much faster and fire a constant stream of missiles at you. If you find the screen full of enemy ships the best thing to do is run away.

The game is a lot easier to play using joysticks, but you are given two sets of keys as an option and they're not too difficult to get the hang of. *Cylon Attack* is an excellent game and extremely good value for money. The graphics are no less than spectacular and the sounds very realistic. I found no fault with it, and it is one that will fascinate me – and I'm sure many others – for a long time.

Ian Rowlings

POD BOD

'Protector', Quicksilva, BBC B, £7.95,

PROTECTOR from Quicksilva, by Andy Green, is well up to his usual standards. The graphics are stunning. Most startling are the wailing flying saucers or UFOs, whose tops pulsate with colour as they cross the screen laying mines. There are other novel features on the title page, which takes a long time to complete but is worth waiting for.

The game can only be played with joysticks, which is a great pity. All the joystick does is move you (the Protector of the title) about the screen and it is difficult to see why this could not have been done just as well by keystrokes.

The main idea is to protect a set of 'pods' in the centre of the screen from thieves. Other hazards are there to stop you, including monsters, the UFOs and their mines. You ram the thieves and the UFOs, and avoid the mines and monsters.

Scoring and 'high score' are as in most games. You can opt for one or two players from the title screen.

This brings me to a 'bug'. Pressing 1 or 2 (for the number of players) bypasses the title screen. If you press the escape key, however, the title screen appears at double speed, but the game hangs up and has to be re-loaded.

Excellent value if you like good graphics, and have a joystick.

Miranda Williams

RAPTOR TRAP

Birds of Prey, Romik Software, BBC A or B and Electron, £6.99

ANOTHER clone of the *Galaxians* game, with a few minor variations. For those who suffer from amnesia, *Galaxians* is similar to *Space Invaders* but instead of the aliens plodding rhythmically down the screen they break off and dive at you, screaming as they come.

Birds of Prey is well presented and packaged, loading in two parts: instructions and game itself. It has a joystick option.

The graphics are fast-moving and clear but the sound effects are pretty average. The new twist are death bombs which stroll down the screen. If they hit the bottom you lose a life.

The game is very addictive and a must for all model A owners, although model B users would be better off buying Acornsoft's *Arcadians*.

Richard Beach and Jason Mallen

CRATER CREATURES

Alien Break-In, Romik Software, BBC B and Electron, £6.99

AN interesting game compared to the normal 'smash the alien' type. In *Alien Break-In* you have been left to defend Earth's uranium supply against the might of the Zargon fleet. As well as being shot at by aliens, a mother ship is dropping pods and bombs. If a pod hits the ground it turns into a spider. The only way to destroy it before it kills you is to dig a hole which it falls into and then fill it up.

If a bomb hits the ground it creates a small crater, and when the hole is large enough an alien will land in it and mutate into another indestructible mother ship. When 10 mother ships have been formed the Zargon fleet comes down the screen and invades – in other words, you've lost.

While loading, a tune is played. It is pleasant at first, becomes a nuisance and then a pain after three or four minutes. The instructions give you the option of changing the control keys to suit your preferred layout (or you can use a joystick), of halting the game if the phone rings, and of turning the sound off. Both sound and graphics are good.

The game provides nine skill-levels from 0 (easy) to 8 (horrendous). It's very addictive, though the only thing to aim for is a higher score. A worthy addition to your arcade library.

Richard Beach and Jason Mallen

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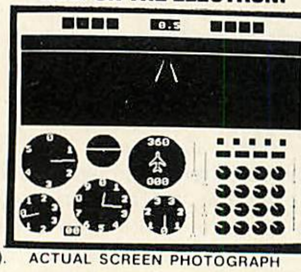
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DRAGON, ATARI 400/800 (48K), BBC MODEL B, TRS 80 C/C 32K

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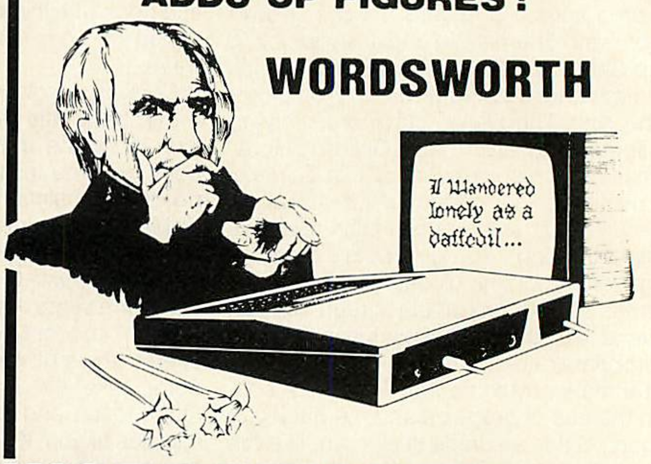
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DO THESE MONITORS WIN THEIR STRIPES?

Sanyo 3125NB colour monitor, Micro-Peripherals, £199 ex VAT; and JVC 1302-2 colour monitor, Opus, £229.95, ex VAT

BEING in need of a colour monitor for my own purposes, it was a boon to be able to review a couple. I am no TV expert so offer no technical advice, merely the experience of a week's trial on my eyes, and a little advice on what you should look for.

First piece of advice on colour TVs is that if it doesn't have an RGB (red/green/blue) input, forget it. The haze that covers all pictures and the poor colour definition that results from going through the normal TV aerial socket make the resulting eyestrain dangerous. This is true of even the best TVs if you make prolonged use of them.

Second, don't be beguiled by the 'video' input on a TV. The Beeb's output is only black and white from its 'monitor' socket, so you won't get a colour picture from that source (unless you make the hardware changes described on page 171 of the January issue).

The two monitors I tested were the 'normal resolution' monitor from Sanyo, and the 'high resolution' monitor from Electrohome, made by JVC. I have used the Microvitec Cub monitor extensively at college, and as this is the Acorn recommended monitor I'll refer to it as a 'standard'.

The Sanyo is a silver-painted metal-cased monitor similar in size to the Cub. It has far better and more accessible controls, but the picture is disappointingly small. On a 14-inch (diagonal measurement) screen, there is an unused border at both sides of more than an inch, and one almost as wide at top and bottom. This gave the picture a squashed appearance and caused some distortion, though the top line was always visible, not needing the use of *TV255,1.

The JVC is plastic-cased and looks like an ordinary TV. The picture was not adjustable, except for brightness, and *TV255,1 was required to reveal the top line of the screen. There were left and right margins of about an inch on the 14-inch screen but none at top or bottom, and no distortion.

The criteria I used to determine my preferences were:
1. The visibility and definition of mode 0 and 3 text.
2. The ability to reproduce the horizontal and vertical striped bands in mode 2, generated by programs 1 and 2.
3. The steadiness of the picture.

The Sanyo is claimed to give character definition at only 40 characters per line. Eighty character text, while not actually unreadable, is tiring to decipher. This puts it in the 'not usable with Wordwise' category. You would have to go upmarket to the high resolution monitor to get satisfactory results in mode 0 or 3. The JVC was excellent, giving clear, legible results.

Both performed satisfactorily on the vertical stripe test, where there are only 160 bands across the screen, though the JVC was noticeably sharper. The horizontal stripe test is a stringent one – try it on your own set. The bands are twice as close together as the vertical stripes, and the Sanyo confused them utterly, giving only four colours instead of the intended eight. The JVC colour bands were visible, though a little blurred.

```
10 REM Vertical stripes
20 MODE2
30 FOR I=0 TO 1279 STEP 4
40 GCOL0,(I/4 MOD 8)
50 MOVEI*2,1023
60 DRAW I*2,0
70 NEXT
```

Program 1

```
10 REM Horizontal stripes
20 MODE2
30 FOR I=0 TO 1023 STEP 4
40 GCOL0,(I/4 MOD 8)
50 MOVE0,I
60 DRAW 1279,I
70 NEXT
```

Program 2

Both gave steadier pictures than the Microvitec Cub, and the colours were rather better.

It seems to me that all 'normal' and 'medium' resolution monitors, including the Sanyo, are simply inadequate to deal with the Beeb's graphics and text output. Was the JVC better than the Microvitec? Would I buy one? Yes to both questions.

George Hill

A FORMULA FOR EXAM REVISION

'Chemical Analysis' and 'Chemical Structures', Acornsoft, BBC B, cassettes £13.80, discs £17.25, inc VAT

THERE are three titles in the Acornsoft 'Chemical' series, although as yet I've been able to get my hands on ony two of them, *Chemical Analysis* and *Chemical Structures*. Maybe *Chemical Simulations* is subject to one of Acornsoft's celebrated delays.

The *Analysis* program has three sections. These are, in tape version, curiously and unnecessarily loaded from a menu. Menus are fine on disc but frustrating on tape, particularly when their effect is the same as typing CHAIN"progname".

The three sections are Elements, Inorganic and Organic. All are fairly unadventurous quiz-type programs in which the student guesses the identity of a substance from data provided by the program. In each you can make a guess or ask for more information from a menu of tests. You score points for correct guesses. The programs are in mode 7, without graphics and run without fiddling about on a standard model B with disc interface.

All three can perform a useful backup function in the study of chemistry for public exams. They are, of course, no substitute for practical work, nor for a skilled teacher, but could well add variety to essentially boring revision. Elements is aimed at 'O' level, while the other two are aimed higher, even at their 'easy' level. I found the misspelling of the plural of 'gas' highly irritating. Talk about illiterate scientists!

Attempts to list the program to discover the answers result in blank data statements so no cheating is allowed.

The *Structures* package contains two programs. Bonding produces semi-animated diagrams of the electron transfers and sharings involved in simple ionic and molecular bonding. (This is commonly known as the 'dot/cross' type of diagram.) 'Shapes' purports to produce 3D diagrams of molecular shapes. More of that later.

In both you are invited to choose by symbol from a periodic table the elements to be investigated, a useful exercise in itself. Certain combinations are impossible and are forbidden by a useful colour-coding.

Bonding is too large to run on disc with the default setting of PAGE, but if PAGE is lowered to &1100 it can be transferred to disc. I found it admirable, aimed principally at the 'O'-level student but providing useful revision material at 'A' level. Its only drawback is in giving the impression that some compounds are very complex, when the only problem is that data for them is not included in the program.

Shapes is a different kettle of fish. First, it is too large to transfer to disc without shifting. Second, it has an extremely limited repertoire of covalent compounds and tells you that simple ionic examples such as sodium chloride are too complex for it to draw (hardly confidence-boosting!). It purports to draw three-dimensional structures of the covalently bonded atoms, and then rotate the structure to *aid understanding*.

This can be much more satisfactorily done by 'ball and stick' models. Only three views of the structure are presented, and these are difficult to distinguish, even for tetrahedral molecules. But the clincher is that for linear molecules three identical views are drawn, one after another, with no way of skipping them. I would not show this rubbish to any of my classes, whatever the level.

These programs are provided with adequate documentation, including both pupil and teacher user guides. My overall opinion was that they were high on price, and rather low on ideas. **Miranda Williams**

A 20K RAM BOOST FOR THE 'B' WITH A UNIQUE PAGING SYSTEM

Aries B20 20k RAM expansion board, BBC model B, Cambridge Computer Consultants, £99.95

THE first thing to consider with any board such as this is how easy it is to fit inside a BBC micro. You might have heard horror stories with other boards about soldering to chips and bending pins, but not in this case. As long as you can take the lid off your BBC and remove chips carefully, you'll have no problems with the Aries B20. You first remove the 6502 chip and refit it to the Aries board, then fit the board back into the empty socket. Finally, the special ROM supplied is slotted into one of the spare sideways ROM sockets. Detailed information on fitting and using the hardware is supplied with the kit.

The first thing to notice is the new screen message 'BBC Computer 52k'. This in itself is gratifying and if nothing else will astound your friends, but this is an impressive piece of equipment in its own right and deserves to be taken seriously.

The additional RAM can be switched in or out using *XON or *XOFF, which means you need never remove the board. This is extremely useful in software development to check if a program runs on a standard machine: given, of course, that it was designed to do so. A hard break will always invoke the 52k, but a soft break will maintain the current state of the system.

The burning question is: 'How much memory is *really* available?' And, secondly: 'Is all of the extra available to run large programs?' The short answer is *yes*. The additional memory is paged as normal, but this is done in a unique way.

With most other add-ons, their paging mechanisms will not allow a large program which resides in both normal and extra memory to be run directly. You would have to store the main program in normal memory and call down other chunks of program from the extra memory to be run as and when required – not an ideal method. The Aries *B20, however*, pages in an entirely different way. As you may be aware, the normal screen area is between &3000 and &7FFF, and HIMEM is set according to the mode being used. The additional 20k RAM of the Aries board is also positioned from &3000 to &7FFF in parallel with normal memory (figure 1). The Aries ROM intercepts all references to the area above &3000 (excluding the screen) and diverts them to the extra RAM. This is dealt with entirely automatically. Hence HIMEM remains set at &3000 while the Aries is switched on and, even allowing for the little extra required by the operating system software, this provides usable memory slightly in excess of 28k, irrespective of screen mode. This won't sound a great deal if you are working in mode 7 as it only provides an additional 1k, but in modes 0 to 2 you get the full 20k extra.

You might feel the expansion is not of great value if you use only low resolution, and to a certain extent for programming purposes this is true. However, it can still provide extra memory for data storage. First you set HIMEM to &3000 to ensure the Basic stack and workspace are not in parallel memory. Having done so there are two data areas available – one which is normal memory from &3000 to &7BFF, and a second which is the Aries RAM from &3000 to &7FFF. If you include the area below &3000 this provides an impressive 47k for data.

Acorn have provided a special command for selecting the data area you wish to access – *FX111,0 selects data area 0 and *FX111,1 selects area 1. Data may be stored or loaded from files into either area and all indirection operators can be used to access either set. The Aries manual even provides a simple routine which allows the two areas to be considered as contiguous memory from &3000 to &CBFF.

When programming in machine code, operating system vectors can be modified as required, as long as you follow the rules. The only exception is that interrupt routines must be located below &3000. Another thing to consider is that because the Aries uses 256 bytes of private workspace, when it is activated it increases OSHWM by &100 (I wondered at first why PAGE was automatically reset from &1900 to &1A00).

The special system call is also useful in machine code programming. Calling OSBYTE with A=&6F (111) and setting X appropriately will allow you not only to select the RAM area to be used, but also to read and write the Aries state and to push or pop this to or from the stack.

The Aries manual also provides some basic information on its use in conjunction with the Torch Z80 Disc Pack using CPN or MCP – for those lucky enough.

An advantage to View users is that without recourse to the EDIT facility a total of 25k of text can be resident at once – a fourfold increase in mode 0. In addition to View, the Aries is claimed to work with both versions of Basic, the second processors, all Acornsoft languages and any software that is written correctly – which of course means it is difficult to estimate what proportion of commercial software will run with the system on. Not that this matters a great deal – you just switch the board off before loading. Wordwise will also run, but because of the way it is written it cannot take advantage of the extra RAM.

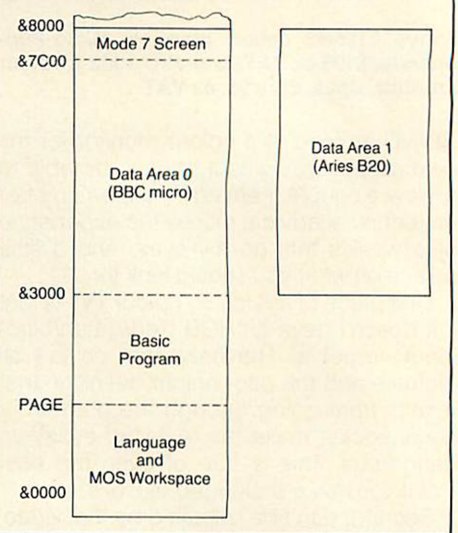
Unfortunately, you cannot use most of the ROM boards available (eg Watford, Sir, ATPL) with the Aries board – they just won't fit. On the question of additional ROMs, it is impossible to say whether the majority that are available will work with the Aries switched on. I found that some of the facilities (ie *MZAP and *MSEARCH) of the Disc Doctor ROM would not work at all with the Aries switched on, which is more than a little annoying. Still, if you do fit a number of add-ons produced by different manufacturers you can't expect them all to be compatible.

With regard to the effect of the Aries system on processor speed, it is claimed that it makes no difference except with some system calls. This is quite true. Tests show that such calls only reduce the speed by between 0.5 and 1.6%.

In conclusion, for those with a serious requirement for 'usable' extra memory this is a good buy, albeit a trifle expensive. Don't be put off if you also need extra ROM – Cambridge Consultants will be producing an expansion ROM board for use with the RAM board. This will support 12 ROMs. The company also intends to produce an external ROM board with its own power supply, which I feel will be of considerable interest. After all, you can't just keep shoving things in – the poor old Beeb can only support so much.

Ian Rowlings

Figure 1.





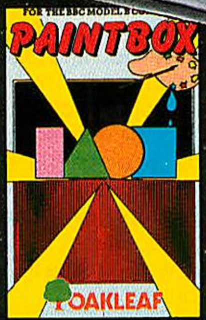
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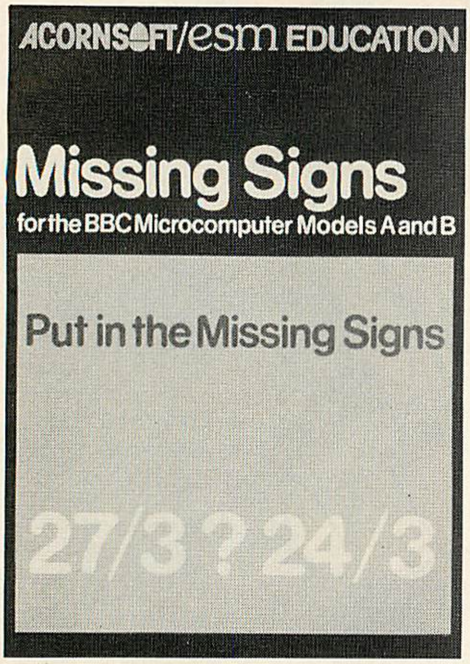
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WHAT'S MISSING IN THE NUMBERS GAME?



Missing Signs by Anne and Russel Wills, Acornsoft (for ESM), BBC A and B, £11.90 (disc £15.35)

THIS pack contains three programs that give practice in the four rules of arithmetic with whole numbers, and in the use of equals, less than and greater than. At the start of each program the teacher can choose the level of the questions for the class by setting the layout, content and degree of difficulty (all chosen from menus) and time allowed.

In *Add-Sub* the program presents two sides of an equation or inequality and the pupil fills in the missing signs. It does not matter whether or not the shift key is pressed to get the relevant characters of the keyboard. Incorrect responses produce a bleep and after two incorrect responses the correct answer is given.

The score is stored for each pupil and can be displayed at the end of that pupil's attempt or at the end of the session. The process is repeated for up to 20 children, who use the same specification – any change would lose the stored results. No help is given to suggest how the results are printed and presumably the teacher copies them off the screen.

Mlt-Div is similar except that the teacher can specify which table is to be reinforced. *Signs* presents pupils with incomplete equations into which they put the correct sign or signs, depending on the level of difficulty. The program copes with quite complex equations where there are different possible answers.

As with many programs which rely on random numbers, the questions in *Missing Signs* can vary enormously within a particular difficulty level and questions are sometimes repeated. There is no teacher or pupil guide and, as the screen is laid out as simple text, the overall effect is of standard but dull drill and practice.

Paul McGee

TUNED UP

Music Editor, System Software, BBC B, £9

WHAT does a music editor do? What can it be used for?

A music editor should let you, the composer, enter music scores quickly and easily and allow the music to be played back in varying ways, particularly where timing and/or speed is critical.

System Software's package is designed for this purpose, and provides some interesting extras. Once the program had loaded, which was difficult, it asked for the key of the music, the tempo and number of voices (maximum three). It divides the number of notes available to each voice so that when three voices have been picked you have just over 300 notes for each. This could be a major drawback if you want to enter long tunes.

After picking these parameters, you are presented with a well laid out editing mode, with which you enter the notes. At the bottom of the screen is a treble and bass clef, complete with the key signature picked earlier on, and at the top are the types of notes available (quavers, crotchets, dotted crotchets etc). These are picked by moving a box over the required note, a particularly nice method. To the right of this are the amplitude levels and a remarkable 16 available envelopes, selected in the same way as the notes. The choice of envelopes allows, together with the 15 levels of amplitude available, 31 variations in the quality of each note. A choice such as this makes possible much more creative use of the Beeb's sound capabilities.

The program provides 16 envelopes to begin with, but any one of these can be changed to those you have designed and these can be saved and loaded back every time you need them. This is probably the nicest feature of this software.

The pitch of the note is picked by moving a cursor up or down the staves, and the note entered by pressing one of a choice of keys – for example, one for a sharp, one for a flat, another for a rest.

Bar lines help to make things clearer and are easily put in.

So once the tune is entered you are presented with the main menu. From this you can edit, play the piece, change envelopes, save the tune, save the envelope paramaters or restart the program.

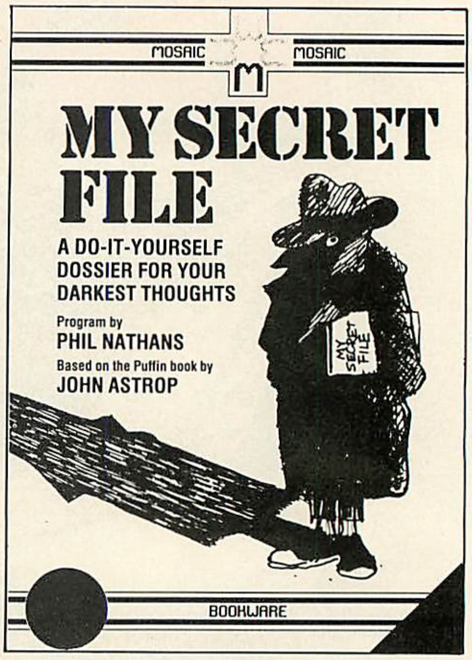
I found editing particularly laborious. For instance, you can't erase a whole phrase and erasing note by note takes a long time. But you can insert and delete notes, which is very useful. A tracking system allows you to see the amplitude or envelope, duration and pitch of the notes as you move the cursor over them – again very useful.

The *Music Editor* system allows creative use of the Beeb's sound capabilities, but the major drawback is the time and effort needed to enter and edit a complete tune, so this program is not for the easily bored.

Jason Mallen

FAMILY PLOT

My Secret File, Mosaic Publishing, BBC B, £9.95.



THIS program comes on cassette in a package with a Puffin book of the same name, which has apparently sold 86,000 copies to date. It enables a child (assumed to be in the 7-11 age range) to fill in a lot of slightly tacky-sounding lists – Dad's statistics, Mum as I see her, My Room, My Brothers and Sisters, etc.

The program is more or less a straight crib of the book – indeed, it mirrors faithfully the concept of filling in your own lists and on the computer you even have a secret password which purports to prevent people of a snooping nature from reading your file after you've written it to tape.

It doesn't really work, though. If I were a parent keen to introduce my child to the concept of a database on computer, even though I didn't know much about computers, I'd quickly come to the conclusion that books whose pages you can flip and write in (as in the Puffin) are a much faster and more convenient medium than a computer using a cassette tape as a storage medium. A little more imagination – such as the inclusion of a SORT or SELECT IF function – would have gone a long way towards taking this package from the dreary to the useful.

Simon Dally

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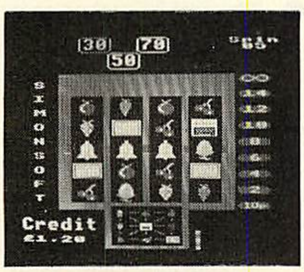
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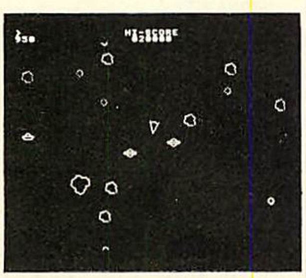
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Actual screen photograph

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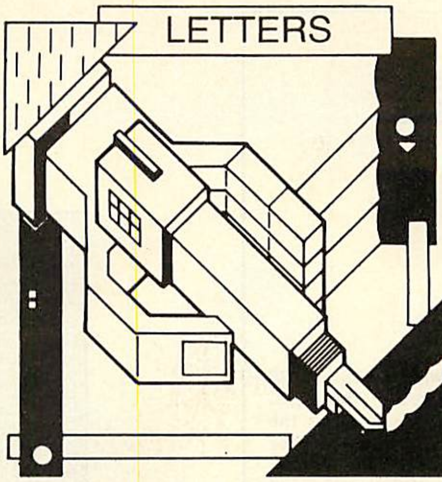
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RESPONSIBILITY OF THE PRESS

Sir, I have recently read Mike Cooke's article, 'Protection Racket' in your February issue. In it he describes how a number of the basic software protection methods work and suggests how these may be circumvented by the average BBC user. I am sorely disappointed that your editorial policy admits the publication of information of this kind, as I have little doubt it will be used for purposes which are less than honourable.

I understand that a recent survey of BBC users indicates that the number of pirate copies of *Snapper* in circulation exceeds the numbers actually sold by a factor of some 20:1. One can only sympathise with Acornsoft who must have committed large resources to developing this program and others like it.

I am aware that software users frequently protest that the copy-protection of software denies them their 'right' to make security back-ups; to transfer programs from tape to disc; and to place several programs on to a single disc or tape. While these activities are all quite respectable, the 'right' to perform them has been so greatly abused, that the publishers now have little option but to withdraw it.

Provided that software publishers deal promptly with returned, corrupted tapes or discs (for, say, a year after purchase), and will transfer returned cassettes to discs for a minimal charge, I see no reason to fault the suppliers, when the software-consuming public is behaving so culpably.

Rather than engaging in such complicit behaviour, may I suggest that *Acorn User* serves its public in a more honourable manner by enquiring of its readers (and publicising) details of retailers who provide a poor service with respect to tape replacement, upgrade, etc.

I am sure many of your readers will be aware that another major UK micro magazine recently published an article which contained information useful to the would-be software pirate. I expect they also know that this magazine subsequently had to part with many tens of thousands of pounds (reports vary) as part of an out-of-court settlement with Acornsoft. It is a great pity that action of this kind is necessary to encourage responsible attitudes on the part of the computer press.

K Pretorius
London

It is not the policy of *Acorn User* to help people circumvent the copyright protection on any software. However, it is our policy to help writers protect their own software. This was, in fact, the fourth article published on software protection, and describes a technique built into the BBC micro's operating system ROM for anyone to use.

As for software publishers dealing 'promptly' with corrupted tapes or discs at 'a minimal charge' and for 'up to a year', we are not aware of any. Our daily post is full of tales of woe from people whose experience is exactly the opposite, and only behind-the-scenes pressure from *Acorn User* has any result.

Software houses are unwilling to make any public statement on 'bugs' and exchanges, because if they did they would be inundated with requests. The policy is: 'if anyone notices the bug and makes a big enough fuss, then we'll change the software'. An upgrade service often cannot be offered to correct the bugs because of the protection methods used.

WATFORD REPLIES

Sir, I refer to my letter 'Watford DFS compatibility' published on page 164 of your February 1984 issue.

As you know I did *not* give my consent to the publication of the letter sent to your publishers and because of this I believe your readers have been given incorrect information. In the third paragraph of the article it states: 'If he would like to return it, we would gladly exchange (free) for DFS 1.3'.

While our company is very willing to assist your readers in updating their DFS ROMs we are unable to do this free of charge. We do make a charge of £4 for this exchange service including postage.

Would you therefore please bring this alteration of the previous article to the notice of your readers.

Nazir Jessa
Managing Director
Watford Electronics

DISC TROUBLE

Sir, I was most interested to read the correspondence from Mr Jessa of Watford Electronics, from whom I purchased a disc to organise a large church membership roll file.

I was using Watford's 1.1 DFS and a Cumana double-sided, twin 40/80 track drive. I reserved the whole of one disc surface for the file.

When I came to initialise the file by writing blank records I found that records 212 and 213 were unreadable. I tried *SAVEing a dummy file of the requisite length and re-initialising to no avail. I always had trouble at the 64k mark.

Having read the letter I called at Watford to exchange my 1.1 system for the 1.3. I was told I would have to pay a further £3.45. I objected and pointed out that there was a flaw and showed your letter. I was told it was part of some private correspondence and was to placate one customer. The blame was also laid on Acorn for not correctly utilising their own system!

After arguing, I reluctantly paid the money. On trying the filing program again, I successfully initialised the file first time.

I feel that Watford and Mr Bray, the author of the system, should face up to their responsibilities and offer free replacement of faulty software. The current version of this system is 1.3. I know of versions 1.1 and 1.2. How many more attempts has the customer to pay for before they get it right?

M Herbert
Leicestershire

SMUG BRAY

Sir, Mr Nazir Jessa, managing director of Watford Electronics, whose letter you published in your February edition, has done some pretty smart back-pedalling. When I sent him my 1.0 DFS for its free upgrade I got it back unchanged with a circular saying you had printed his letter without his consent or knowledge and that if I wanted the upgrade I'd better send him £4.

I took the line of least resistance and sent along a cheque for the sum demanded. I included a letter to say that I did so under protest, as the 1.0 DFS contains flaws of which the most obvious is that the *EDIT command will not work in Drive 2.

I now have my 1.3 upgrade, along with Watford Electronics' apology 'for the inconvenience caused'. Unfortunately my £4 has been wasted. The new version won't *EDIT in Drive 2 either!

The 1.3 DFS contains the following interesting message at location BC78. 'This DFS comes to you by courtesy of Andrew Bray and Watford Electronics. We consider the WE DFS to have all the features needed so DFS 1.3 is the definitive feature set. Other DFS authors please take note this is the standard you must achieve. . . .'

Stephen Fox
Cheshire

The letter from Watford Electronics which we printed has obviously caused confusion and comment, and we are happy to allow Mr Jessa his statement.

Let us now hope he will be the *first* to advertise an upgrade service, for those who originally bought the 'fully compatible' early versions.

The DFS message is certainly an example in asking for trouble!

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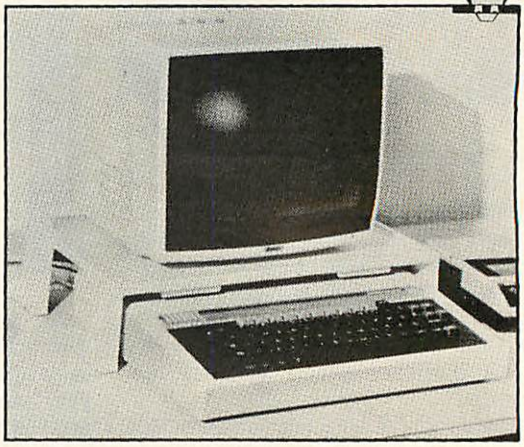
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NO ROOM

Sir, I have been using a BBC micro for about six months and the only slight concern is the lack of memory in the lower modes. I often want to write programs which output a table of results and have to use a lot of DIM statements in mode 3.

Although only 3k long, these programs run out of memory during a run, due to the DIM space required. Invariably I get the message: 'No room' or 'Bad DIM'.

Do you know how the memory can be expanded so I can use larger DIM statements in lower modes? Would another memory chip suffice?

John Luckcock
Middlesex

Adding extra memory chips is no easy matter because the 6502 microprocessor already addresses its maximum of 64k – 32k Basic and operating system, 32k user memory.

If you want more memory in which to run a program, the answer is either to wait for a second processor, or buy something like the Aries board which is reviewed in this issue.

ROM SHIFT

Sir, Terry Holden's comments about ROMs using the same commands in his review of Computer Concepts' Disc Doctor (page 143 February edition), bring to light a problem that could be more serious than he first thought.

I fitted a Beebase-1 database ROM from GCC in Cambridge into a model B which already had Beebcalc from Computer Concepts. Unfortunately, both these ROMs respond to the minimum command *BE.

With Beebase in position 2 (second from left) and Beebcalc in position 3, *BE. accessed Beebcalc, but Beebase could not be called at all, *BeeBASE or *BEEBASE giving 'Bad Command'.

Changing the ROMs so Beebcalc was in position 2 and BeeBASE in 3 allowed *BE. to access Beebase, but Beebcalc required the full name or a minimum *BEEBC.

D Buckley
Middlesex

DOCTOR CURES

Sir, Having read Terry Holden's excellent review of the Disc Doctor EPROM, I have two suggestions, which I have found from using it.

First, as Terry says towards the end of his review, it is sometimes impossible, seemingly, to use certain commands. However, if one knows which socket the EPROM is in, it can be disabled. Thus, if it was, say, from the given example, the Watford DFS which was causing the problem, and it was in socket (n), then ?&02An=0 would disable it. It is worth, before doing this, finding out what the value should be, by doing a PRINT ?&02An.

This will enable the ROM which is disabled to be re-used later on, by putting back the value found above with ?&02An=XX.

You can make sure that your actions have worked by using the *HELP command, to see if the operating system knows of the EPROM's existence.

Second, there is a bug in View, such that if fitted together with Disc Doctor, some of the Disc Doctor commands don't work.

This is because of the way View handles a system command, eg *TAPEDISC. This is offered round all the ROMs, until one of them recognises it, and takes control.

However, View, while checking, corrupts some parts of memory which it should be leaving alone! Therefore, to use a command in Disc Doctor which does not seem to be working, it is worth trying first of all moving the ROMs to give Disc Doctor a higher priority, so that it sees commands before View. However, this does not seem to work for all commands, and the above technique, of disabling View by software always works. (Unless you know different!)

My thanks to Acornsoft for explaining all this to me.

R Hallsworth
Oxfordshire

FAST SHUFFLE

Sir, I recently read the two letters in your February issue in reply to J O'Brien's request for a 'non-repetitive' random number generator. Both the solutions published suffer from the same problem, namely it can take a long time to get there!

I have used the procedure below to 'shuffle' a pack of cards.

As you can see, this method takes exactly 'items' steps every time. It may not be obvious that this method is uniformly distributed, but a moment's thought shows that each number has a chance of being picked of 1/items at a particular stage.

Stephen Rogerson
Maidenhead

WHITE MOVE

Sir, As author of the BBCSoft chess program *White Knight*, I was pleased to see it reviewed in your January '84 issue. There were, however, a few points in the article which I would like you to clarify.

John Vaux stated *White Knight* could not solve the position in figure 6. This is untrue – *White Knight* can solve it in less than 30 seconds if set on a high enough level. I presume the trouble the reviewer had was that *WK* never looks very far ahead when the move number is 1 or 2. This is so that little time is wasted on the opening two moves. The reviewer should try the position with the move number at 3 or more.

Next, the reviewer said the program searches 50,000 positions each minute. It is in fact more than this, at about 72,000 (1200/second).

Finally, Mr Vaux was unable to play the programs against each other. In tests, *WK* beat all the other BBC chess programs by 16 games to nil! It also won the home-computer section of the 1983 European Championships.

M Bryant
Basingstoke

LOUSY CHESS

Sir, I read the article on chess in January's *Acorn User* and I would like to ask a few questions.

I originally came to computers through my interest in chess. Of course, since then I have become 'addicted' to them and spend many happy hours working out mathematical puzzles, programs and so on.

My experiences with chess have not been very satisfactory. I have a program called *Microchess* which I use on my ancient Commodore Pet. This plays in a reasonable time and doesn't play too badly. At the top setting, however, I can always beat it, unless I am drunk or watching the television at the same time! I would like to think this is because I am a Master player, but years of playing mere human beings

```
10REM Shuffle
20REM
30items%=10
40DIM list%(items%)
50REM
60REM Initialise the array
70REM
80FOR I%=1 TO 10
90list%(I%)=I%
100NEXT
110REM
120REM Initilise the random
   number
130REM generator.
140REM
150I%=RND(-TIME)
160REM
170PROCshuffle(items%)
180END
1000DEFPROCshuffle(items%)
1010LOCAL I%,J%,S%
1020FOR I%= items% TO 2 STEP -1
1030J%=RND(I%)
1040REM
1050REM Swap the I%th and J%th
1060REM elements
1070REM
1080S%=list%(J%)
1090list%(J%)=list%(I%)
1100list%(I%)=S%
1110NEXT
1120ENDPROC
```

The Rogerson shuffle

has demonstrated this is not so!

The various programs I have used on my BBC micro can all be described in one word: 'Lousy' — with one exception. This is *Chess 2.32 Version E* by David Thompson. Like *White Knight*, this also takes its 'intelligence' from the time it takes to move and, when it is set to take six or seven minutes to move, it really does play quite good chess. Unfortunately this means nearly four hours to reach the middlegame!

At one point in the article, the writer comments on the program's 'amazing speed' and then, talks about setting the move time to 59 minutes 59 seconds! To reach the middlegame at this rate would take about 30 hours!

P Arrey
Surrey

It's difficult to say whether White Knight will beat you, but it's the best we've met on a Beeb – although the David Thompson game has never come to our notice.

Perhaps the letter above, especially with its reference to the chess championships, will make up your mind. Let us know how you get on.

STRING REPLY

Sir, With regard to Ian Tresman's letter (December p161) commenting on my hint (August p51), it is not quite correct to say the same effect can be achieved using *FX 141, because my routine can quickly insert a whole string of characters at once, not simply one at a time. A similar program for the 1.2 OS would be:

```
10 P%=&900:[OPT2:.INSERT:LDX#0:.
   L%:LDA&930,X:CMP#13:BNEP%+3:
   RTS:CMP#124:BNEP%+8:INX:
   LDA&930,X:AND#31:STX&92F:
   LDX#0:
   JSR&E4B3:LDX&92F:INX:JMPL%:]
20 $&930="GOTO300|M"
30 CALL INSERT
```

Perhaps it should be emphasised that, as can be seen from this routine, once the string has been set for the first time, all that is needed to insert it subsequently is the CALL INSERT command.

Alex Selby
London

250X DUMP

Sir, I own a Seikosha 250X printer and was particularly interested in September's issue featuring SKASS, the hybrid graphics program for Seikoshas.

On the assumption, probably wrongly, that the 100A and 250X were similar, I changed the control codes in SKASS to those for the graphics mode on my machine. This was partially successful as a neat straight line followed.

Unfortunately, this line bears no relation to what appears on the screen and perhaps most interestingly always ends with the word 'pape' accompanied by what appear to be authentic French accents!

Can you help, or should I assume my BBC and Seikosha have the correct answer and drown my sorrows in a bottle of Chateauneuf du Pape?

A Moreton
London

George Hill replies: I'm afraid the 'pape' phenomenon is only too easy to explain. Pape, and pate, possibly to go with the wine, appear as the result of a series of commands sending ASCII codes greater than 128 to the printer. In this region the printer keeps its 'extra' characters for international character sets. If you read the text of the article you will find that the Seikosha 100 *must* have its graphics bytes greater than 128, and these are having odd results on the 250.

The graphics commands, and facilities of the Seikosha 250 series of printer are *not* the same as for the 100 series. It resembles much more closely the Epson system. It prints eight-dot wide bands, not seven, and has escape se-

```
1000DEFPROCDUMP
1010REM SEIKOSHA GP250 DUMP
1020REM G.B.HILL (c) 1983
1030VDU2,1,10
1040VDU1,27,1,76,1,2
1050FOR Y%=1023 TO 0 STEP-32
1060VDU1,27,1,71,1,1,1,64
1070FOR X%=0 TO 1279 STEP 4
1080byte=0
1090FOR y%=31 TO 0 STEP -4
1100byte=byte*2
1110IF POINT(X%,Y%-y%)>0THEN
    byte=byte+1
1120NEXT
1130VDU1,byte
1140NEXT
1150VDU1,10
1160NEXT
1170VDU1,10,3,7
1180ENDPROC
```

quences to determine the number of dots per line printed, and the line spacing.

The Basic program above will dump the screen on the 250. To prepare a printer byte for it in machine code requires a process not unlike the Seikosha 100 method, but it must be an eight-dot wide byte not seven, hence count_7 is initialised to 8. (It would be sensible to rename it count_8, but this will have no effect other than to increase legibility). Also, byte should either not be initialised at all, with some slight increase in speed, or initialised to 0. Again this will have no noticeable effect, as the first bit in will be rotated right out anyway, and so is irrelevant.

BEN BETTERED

Sir, Reading some of the letters in the January issue of *Acorn User* it seems that there is some interest in making Basic programs run using *RUN. Ben Clarke's idea outlined in his article on program protection was neat but left room for improvement (Beeb Forum, page 69).

The problem seems to be to have a system which relies only on operating system calls which sets the value of PAGE, initialises all the pointers correctly and runs the program. Also although putting the code in a REM statement is a nice idea it does tend to make the program listing ugly.

Putting the relevant commands to the Basic interpreter into the keyboard buffer, each followed by a carriage return, works. One of the things I find useful though is to have a soft key set up to set PAGE, obey OLD and run a program.

Simply, then, the method for auto-running is to put some machine code directly above the Basic program in memory. This code sets up a soft key definition and puts the soft key value in the keyboard buffer.

The Basic program below achieves this. The user should input the program to be auto run, and then print out the Basic pseudo-variable TOP. Setting PAGE well clear of this (leaving at least 50 bytes free), load and run this small program. When both the value which TOP had, and the value to which PAGE is to be set on auto-running have been typed in, the program assembles some code above the old value of TOP. It then prints out the form of the *SAVE command the user must use to save the auto-running Basic program.

The program uses soft key 10, the break key, so the program will re-run itself whenever break is pressed. Others may not find this useful, but it is a simple matter to change the number of the soft key used!

Paul Towers
Cambridge

```
10  INPUT "What value did TOP have ";T$
20  INPUT "What value does PAGE need
    to be ";PA$
25  T%=EVAL(T$):PA%=EVAL(PA$)
30  $T%="K.10PA.="+STR   (PA%)+"
    |MOLD |MRUN |M"
40  P%=T%+LEN($T%)+1
50  E%=P%
60  [LDX#T% AND &FF
70  LDY#T% DIV      \address of
    &100             command line
80  JSR &FFF7       \call OSCLI
90  LDA#138         \insert char in
                    buffer
100 LDX#0           \keyboard buffer
110 TAY             \138 = soft key 10
120 JMP &FFF4       \OSBYTE
130 ]
140 PRINT "NOW TYPE:-"
150 PRINT "*SAVE ?????? "; ~PA%;"
    "; ~P%;" "; ~E%
160 END
```

PEN PAL

Sir, Before I start, I would like to thank you for an excellent magazine. However, I would like to ask if you know a fast print routine – I've tried Basic, but it's too slow.

Also, here in Belgium, there isn't much to do with a Beeb, so I'm looking for a pen pal in England to exchange ideas and routines.

My address is: Heideloom 13, 8200 Bruges, Belgium.

Sys Johan
Belgium

TAPES: HOW TO GET A RUN FOR YOUR MONEY

WE still receive a lot of complaints from people who haven't been able to load some commercial software, so here we'll run through some things to try (in addition to March's Hints and Tips article by Martin Phillips). Most of the tips have come from Micrograf, and their experience of problems.

First, let's look at the cassette tape itself. Often, the program is recorded on both sides of the tape with slightly different parameters, so if one side won't load, try the other. Listen to the tape playing to check it has been recorded.

Sometimes, new tapes can be a little tight at first. This can cause a fluctuation in the loading speed, giving error messages on loading. To overcome this, run the tape through your recorder on fast-forward and then fast-rewind. This should loosen the tape and prevent sticking.

A game may consist of more than one program loaded consecutively. If your tape recorder does not have an auto-stop facility, ensure you stop the recorder after each program has loaded, otherwise the tape may run beyond the start of the next program and the computer will not pick it up.

Now on to the cassette recorder. Some of these are more compatible with a particular computer than others. If they don't match, error messages can occur on loading (refer to the *User Guide* for these). Under such circumstances, volume and tone control settings are likely to be more critical and both should be adjusted. Normally, ideal conditions will occur with the volume high and the tone at one of either extremes, but it may take some time to obtain the desired result.

One other point to consider is that the type of connector used can affect compatibility. If you have the option of using DIN or jack socket connections you may find one type more suitable than the other (see February Hints & Tips).

Many people forget to clean the cassette recorder heads regularly and this too can prevent loading. Refer to your cassette recorder manual and use a proprietary cleaner to prevent this.

Finally, the BBC machine itself. Don't pull the cassette lead in and out with a jerk, or while the micro is on. In the first case you will strain the socket's links to the main board, and the second can damage chips because of static.

Always check before you buy whether a game will run on your machine. Is it model A, model B, 0.1 or 1.0 series operating system? If upgraded from model A to model B, has the 6845 chip been fitted? This controls 'hardware scrolling' on games like *Rocket Raid* and *Defender* (see Ken Worrall's article, page 36). Certain ROMs or hardware additions will also affect some software (see other letters in this issue).

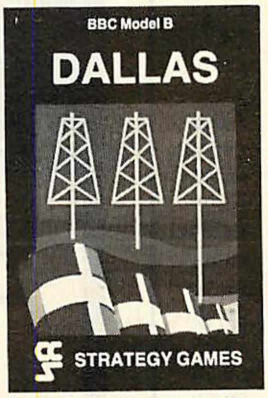
If everything here fails, try other commercial programs, and consider getting your micro checked out. If you return the tape, there should be no problem getting an exchange or your money back from reputable stores and manufacturers.

PLANE SAILING

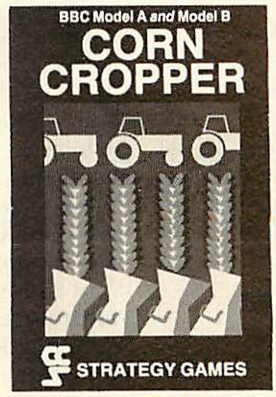
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CURRAH 220M Minidigital cassette recorder 128k cassettes read write 6,000 bits/sec. Suitable for UK101, Pet etc. Connects direct to expansion bus. Almost new, £140 ono. Faller, 01-449 1808 after 6pm.

ACORN Atom graphics commands: circle, arc, triangle, dotted lines, etc. M/C modules #37CE, #3800, #3930; alternatively #A000, with extended plot etc for ROAM board. £5.25. M. Radley, 1 Bournehall Ave, Bushey, Herts WD2 3NP. State which.

ATOM software wanted: buy or swap, would like good version of Donkey Kong or Robotron: 2084. Tel: Blyth (0632) 361096 after 5pm (not Monday or Thursday). Ask for Bruce.

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DISC Doctor ROM and manual, new, £20. Also Beebug mag, cassettes, Beebcalc, Database mailist, Desk Diary, Home Accounts, Record Keeper, Fruit Machine, Arcadians, Music, Peeko, Wordpro, 747 Simulator, etc. Sell or swap. Tel: 0635-63854.

CLARES Replica II, £9. Clares The Key, £9. BBC User Guide (mint), £7. Beebug magazine Vol 1 Nos 1 to 7, bound, £5. Welcome tape (unopened), £3. Exmon, £3. Ratna. Tel: 01-449 5707, daytime.

COMPUTER Monitor Prince, 12in, green, 24MHz bandwidth, £65. Will deliver for cost of petrol. Ken Michaelson. Tel: 01-455 8831.

SELL Salamander software – 737 Simulator, £7 ono. Also games wanted: Hopper, Killer Gorilla, etc. Also joysticks (official) wanted. L. Calvert, 9 Irvine Crescent, St Andrews, Fife KY16 8LG.

PRINTER Seikosha GP250X c/w friction-feed adaptor, two spare ribbons, manual, boxed. Will deliver for cost of petrol. £180. Ken Michaelson. Tel: 01-455 8831.

BBC model B fitted with Watford Electronics DFS with cassette leads, etc. Brand new, unwanted Christmas present. £425. Eric. 01-340 2586 (N. London) evenings, weekends.

BBC B 1.2OS, disc interface, includes all cables, software worth £200 (all best sellers), and books including Advanced User Guide. £400 ono. Nigel. Tel: 021-422 3151 after 6pm.

PUKE program for sale. Actually it's very good but 'Puke' catches the eye! Vortex (Software Invasion) three days old! Unwanted gift (I've already got it). £4. Tel: 051-336 2812 after 6pm.

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SHARP PC1251 pocket computer with printer and cassette recorder. Unused Dec 83, cost £180, sell for £100 ono. V. Bryant. Tel: Wrington 862451 (Avon).

BBC software half-price. All originals: Killer Gorilla, Moonraider, Timetrek, Atom Smasher, Birds of Prey, Bunfun, Supergold, 3D Bomb-Alley, Bug Blaster, Starship Command, Snapper, Rocket Raid (Space Hi-Way on disc). Tel: Bourne End 23544.

LISP Acornsoft cassette plus glossary for sale, £10. Tel: 0707-53433 after 6pm.

WANTED: View or Wordwise, RH Electronics colour light pen, and Cumana, Amcom or Pace single disc drive. Simon Ward. Tel: 01-398 2523 evenings.

SEIKOSHA GP100A printer for sale. Takes standard 9½in paper. As new (still boxed). BBC screen dump software. Bargain at £140. Pete Philips. Tel: 0734 786568.

WANTED! Atom software, particularly Bug-Byte. Anything considered. Write with details and price to Philip Arkley, 384 Whalley Road, Clayton-le-Moors, Accrington, Lancashire BB5 5QX.

VIDEO Genie, expansion interface, green screen monitor, tons of software, £390. Pascal compiler V5.3, £55. Texas TMS2564 8k EPROMS, £4. Write for details: Mike Tubby, PO Box 119, Leicester LE2 7EP.

WANTED. Atom software, especially Acornsoft's Synthesiser, Games Packs 1, 5, 8, 9, 11 and Program Power's Chess, Cowboy Shootout and Invaders. Tel: 061-439 3193 after 5pm weekdays and weekends.

BBC model B OS 1.2 with audio output for external amplifier, manual, welcome tape, etc. £325. Tel: 0727 74168 evenings.

ELECTRON, less than one month old. Still under guarantee. Must sell to purchase BBC micro. £200 including free Meteors, Moonraider and Killer Gorilla programs. Christopher. Tel: Leics (0535) 392860.

COLOUR Atom 12k RAM, 12k ROM incl FPoint. VIA, printer interface to Centronics 150CPS dot matrix printer. Top quality. Single, double width print. Full service manual. £120 each ono. Tel: 01-778 1944.

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SWAP your BBC software with me. Lots of titles including Snooker, Zalaga, Flight 737, Vortex, Hobbit and many others. Tel: 01-921 8627 day, 01-445 8793 evenings.

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AN unwanted Wordwise with manual, £25. Plus BBC software cassettes: Chess, Snooker, Wall, £5 each. Tim. Tel: 01-727 2126.

ACORN USER magazines. Feb '83 and Apr '83 – mint condition. Will exchange both for issue No 1 (July '82) in good condition. Dawson. Tel: 0274-671619 (Bradford).

BBC hardware Micro Man light pen, £15. Spectravision Quickshot user port joystick, £10. Big Ears speech recognition system, £35. All with software on tape. £55 the lot. Tel: 0698 791940.

BBC model B OS1.2; Wordwise, Beebcalc chips; manuals; tapes including Music Processor, Microtax; all Acorn User, Beebug magazines; CCR800 tape recorder; £350. Tel: Orpington 25052.

BBC B 1.2OS, disc interface, 400k disc drive (uncased), leads, etc. Over £100 of software: Acornsoft, Program Power, etc. Manuals, books and magazines. Worth £900, sell for £650. Tel: Poole (0202) 675550 after 6pm.

ORIGINAL Planetoid and Snapper for sale. Hardly used because of upgrade to disc. £5 each. G. H. Loh, Holbein House, 61-63 Evelyn Gardens, London SW7.

BBC – games and other programs to swap (very large range). Also excellent chemistry program to sell, £4. Sean. Tel: Welwyn 4053 (weekends or after 5.15) for details.

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BASIC programmers utility. Provides nine utilities via function keys including formatted listing, bad program fix, verify file, compress Basic, single key entry, etc. 1.2OS required, £3. Cassette system only. Tel: Cardiff 0222 691864.

ACORNSOFT cassettes. Defender and Snapper (early versions), £5 each. The Dating Game (two cassettes), £6. All original copies in original packages. Tel: 040 24 51423 (Hornchurch, Essex).

SOFTWARE for sale. Romik's Alien Break/In, £3, Transistors Revenge, Heist, Croaker, Cybertron Mission, £3.50 each. Graphics ROM, £15, Spy, £12, Beebcalc, £15, Wordwise, £15 or all for £50. Tel: Harpenden 69152.

QUICKSHOT joystick with joystick driver program. Connects to the BBC user port. Would cost you £20, sell for £15 (one month old). Tel: 041-946 9110 any time after 6pm.

WANTED. BBC micro DFS. Must be Acorn release 0.90. Will accept DFS chip or entire interface. Will pay well. Mark Leslie. Tel: Welwyn Garden City 35949 after 4pm.

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BBC micro software by Acornsoft, Program Power, Bug-Byte, Kansas, Gemini, BBCsoft, DACC, IJK, Beebugsoft, Pro, Database software, Salamander. Including Rocket Raid and 747. For more details tel: Bristol (0272) 561237.

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■ **Supergolf**, Trafalgar and Bunfun are well established top quality games for BBC B and Electron. Available at the reduced price of £6 each direct from Squirrel Software, 4 Bindloss Avenue, Eccles, Manchester M30 0DU.

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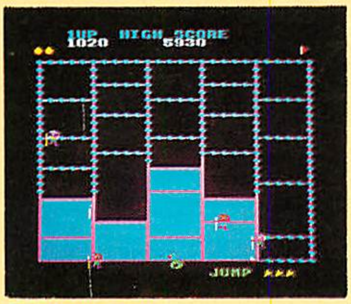
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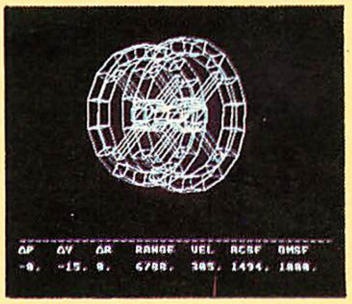
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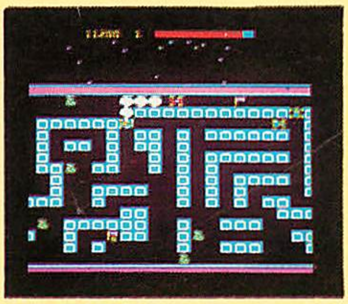
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